The impact of the Covid-19 pandemic and the factors influencing its effect on financial performance: Evidence from Belgian companies

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THE IMPACT OF THE COVID-19 PANDEMIC AND THE FACTORS INFLUENCING ITS EFFECT ON FINANCIAL PERFORMANCE: EVIDENCE FROM BELGIAN FIRMS

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LIST OF ABBREVIATIONS

DF = Degrees of Freedom

GDP = Gross Domestic Product

IMF = International Monetary Fund

NACE = Nomenclature Statistique des Activités Economiques

OECD = Organization for Economic Cooperation and Development

ROA = Return on Assets

SA = Société Anonyme

SCA = Société en Commandite par Actions

SCS = Société en Commandite Simple

SNC = Société en Nom Collectif

SPRL = Société Privée à Reponsabilité Limitée

SPRLU = Société Privée à Reponsabilité Limitée Unipersonnelle

VIF = Variance Inflation Factor

WHO = World Health Organization

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENT

I. INTRODUCTION

The outbreak of the Covid-19 pandemic in early 2020 marked an unprecedented global crisis, affecting virtually every aspect of society, including public health, social interactions, and economic activities. As the pandemic unfolded, it became increasingly evident that the business landscape would be significantly impacted, with many firms facing numerous challenges to survive and thrive in this unforeseen and adverse environment. In this master thesis, we seek to explore the determinant factors that can influence the performance of Belgian firms during the Covid-19 crisis, with a focus on identifying variables that may positively impact business performance among this economic downturn. Like many other nations, Belgium, has experienced severe economic repercussions due to the Covid-19 pandemic. The imposition of strict lockdown measures, social distancing protocols, and supply chain disruptions has led to reduced consumer demand, operational constraints, and financial instability for businesses. Understanding the factors that influence the performance of Belgian firms during this crisis is therefore of paramount importance for policymakers, business leaders, and stakeholders as they strive to navigate these uncharted waters.

This master thesis will be separated into several main chapters. First of all, the literature review will present all the relevant theoretical aspects related to our subject, thus allowing us to develop a deep knowledge of the subject in order to build hypotheses. It will expose an in-depth examination of the Covid-19 pandemic's economic consequences and its parallels with past economic crises. Understanding how previous crises have affected businesses can provide valuable insights into the potential impact of the current pandemic on Belgian firms. Furthermore, the review delves into the mechanisms through which economic downturns cause a drop in business performance, including factors such as reduced consumer spending, disrupted supply chains, decreased investor confidence and global phenomena of recession. In addition to understanding the challenges posed by economic crises, the literature review explores how companies can employ financial characteristics to mitigate the effects of such crises. By analyzing empirical research, we gain a deeper comprehension of the strategies and practices that have proven effective in sustaining business operations during turbulent times. Thanks to this literature review, we present the theoretical framework and develop five hypotheses that serve as the foundation for our research.

This research adopts a quantitative approach, leveraging data-driven analysis to investigate the determinant factors influencing the performance of Belgian firms during the Covid-19 crisis. The study will utilize secondary data thanks to the available Uliege database Bel-First. We will construct five models on the basis of our five hypotheses and select variables to quantify it: all this implementation will be explained in the chapter concerning data collection and methodology.

Afterwards, we will come to the part concerning the presentation of the empirical results. The analysis will test the hypotheses and employ multiple linear regressions to examine the relationships between the identified factors and business performance. The following chapter will present the results obtained from the regression models and provide a comprehensive analysis of the findings. Next, a discussion section will interpret the results in the context of the existing literature and draw conclusions about the determinant factors impacting the performance of Belgian firms during the Covid-19 crisis. The final chapter will summarize the key findings, implications, limitations, and contributions of the research, along with potential avenues for future studies.

The primary aim of this master thesis is to identify and analyze the determinant factors that can significantly influence the performance of Belgian firms amid the challenges posed by the Covid-19 crisis. By gaining insights into these factors, we seek to contribute to the development of effective strategies and policies that can aid businesses in not only surviving but also thriving during this unprecedented crisis.

In addition to its main purpose, we have also identified several specific objectives that this master thesis pursues:

- To analyze the Covid-19 health crisis as well as past economic crises, with the aim of drawing relevant lessons and parallels to better comprehend the current crisis implications.

- To investigate the ways in which economic downturns can cause a drop in performance for companies, as well as the ways by which these companies are trying to counter the harmful crisis effects.

- To provide an overview of much of the literature provided by the academic community about financial performance and all its derivatives.

- Help managers to identify the factors that may or may not improve the financial performance of their company in the face of a global crisis such as the Covid-19 pandemic, by highlighting and exploring the concepts related to firm performance.

- Contribute to recent research on the Covid-19 pandemic by providing insight into its impact on the Belgian business world.

II. LITERATURE REVIEW

1. Covid-19 pandemic

1.1 Covid-19 definition, origin, and consequences

We will begin this literature review by studying the global phenomenon that concerns this master thesis: the Covid-19 crisis. This pandemic being specific and unprecedented for the whole world, with enormous consequences at all levels of society, it is therefore important to understand the scope, impact, and complexity of this period. Indeed, the damage of the pandemic is not limited to the number of deaths, infections, or cases: the virus not only causes these direct consequences on populations, but it also causes indirect consequences, in particular on mental health or inequality (Scwheiger, 2022). In this section, we will therefore discuss both types of consequences.

The direct consequences of the crisis are obviously linked to the disease aspect. To first provide a definition of this virus, the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2), causing coronavirus 19 or Covid-19 disease, is characterized as a highly contagious and pathogenic viral infection (Pinshi, 2021). According to Payne (2017), Covid-19 is a spherical-shaped RNA virus, similar to a crown, caused by an infection belonging to the Coronaviridae family. First identified in December 2019 in Wuhan, in China, the disease was initially of unknown origin, presenting the classic symptoms of pneumonia, and had been detected in several people associated with the Huanan Seafood Wholesale Market, a live animal and seafood market that may be considered as potential starting point of the epidemic due to a transmission from animals to humans (Ren et al., 2020). Quickly, the population realized that the epidemic was highly contagious, and the virus spread throughout the world and claimed many victims, including a lot of deaths.

Covid-19 is therefore a complex disease, infectious and evolutive, which involves viral, inflammatory, and thrombotic phases. It spreads mainly through respiratory droplets when infected people cough, sneeze, talk, sing, or breathe (Bonny et al., 2020). The common symptoms are not specific but include fever, general weakness, dry cough, difficulty breathing, and headache. Patients may suffer from acute respiratory distress syndrome in the worst cases; however, some patients may exhibit no symptoms and therefore be considered asymptomatic (She et al., 2020).

Today, there are approximately 6.9 million deaths worldwide reported and attributed to this disease (World Health Organization, 2023). To better understand the seriousness of the situation, the *Figure 0.1* placed into the appendices shows the extent of the distribution of the disease by counting the number of deaths by region of the world, as of March 11, 2023. If the enormous number of deaths listed in the world depends on the capacity of each country to declare its deaths by Covid-19 as well as on the criteria used to declare them, it is also probably non-exhaustive (Garcia et al., 2021). According to the World Health Organization (2023), the number of deaths not recorded as deaths due to Covid-19 is also very substantial and largely underestimated: most of continents around the world have reported several excess deaths exceeding one million. The World Health Organization (2023) has also revealed a number of cases of people infected with the virus at more than 759 million people worldwide, as of March 11, 2023. Humanity had already experienced epidemics in history, such as the plague, yellow fever, AIDS, or Ebola, but the Covid-19 pandemic is truly unprecedented, in its global scope and in its speed of expansion (United Nations, 2020).

But infection and mortality are only the tip of the iceberg: all crises have hidden consequences. Indeed, these indirect consequences include many adverse non-health effects. This pandemic being an unknown and unexpected situation in history, this less visible side is of course subject to many interpretations and computations. It’s not only about the consequences which concern the question

of who is infected and how to deal with it: direct and indirect consequences suffered by populations, highlight the vulnerability of our society (Scwheiger, 2022). The virus is seen as an invisible assassinator and, although it is often seen as blind and egalitarian since it can affect anyone, its consequences fall most severely on weaker groups, especially among populations in developing nations (Aarts & al., 2021; Cattacin, 2020). It reflects the inequalities between populations and the weaknesses of our systems, especially with regard to access to health care, the availability of vaccines and the speed of reaction to health emergencies (World Health Organization, 2023). Ethno-racial discrimination also stands out more during this pandemic, aggravating the phenomenon, whether through differentiated access to care or even just by refusing access to care because of the barriers of fear anchored for centuries against the authorities and the social life (Azria et al., 2020; Carde, 2021). Other inequalities have arisen, such as age, employment, living conditions and the socio-economic context of populations. In addition to inequalities, mental health has also come under severe strain during this pandemic. Mallett et al. (2022) identified several groups of people at high risk of mental deterioration: teenagers and students, people whose loved ones have been killed by illness, and healthcare personnel. The health problems were accompanied by constant psychological stress that declined in several forms of disorders. Covid-19 leads to a reconsideration of all these inequalities and ultimately offers a great opportunity to rethink the rights of individuals in all these dimensions of life, starting with the protection of global health (Damon, 2020; Cianferoni, 2020).

As it is a dynamic pandemic which operates with several unpredictable waves including phases of movement and stabilization, it is difficult to compute and predict it: the mathematical models constantly need to be updated due to the various changes and variables that can influence the virus propagation (Nesteruk, 2021). But mathematicians are not the only ones struggling to understand the ins and outs of the Covid-19 epidemic. Many conspiracy theories have also emerged: these theories are generated by tensions between groups and fuel these same tensions, particularly in a crisis where the future of the population is threatened and uncertain (Douglas, 2021).

1.2 Governmental measures to control the pandemic

Like different groups of individuals, some countries have also been affected more than others by the health crisis. As an example, Belgium was severely hit by the Covid-19 pandemic. According to data from the website of the World Health Organization (2023), the number of Covid-19 cases in Belgium stands at over 4.5 million up to April 2023, and the death toll from covid stands at over 30,000. The *Figure 0.2* placed into the appendices shows the evolution of the pandemic in Belgium in terms of the number of deaths. As shown, the figures related to the number of victims of Covid, whether worldwide or in Belgium, are extremely high. It was therefore imperative for the Belgian government and the governments of each respective country to set up measures to contain the pandemic.

Belgium was one of the first countries in Europe to announce general restrictive measures. But all the governments of the world have not reacted in the same way: there are different systems implemented according to different state traditions. In general, governments and public administrations have often been seen as slow and inflexible entities (Rainey & Stainbauer, 1999). But according to Anttiroiko and Arto (2022), who studied how political regimes or administrative traditions affect government responses to Covid-19, western countries (such as Europe and the USA) have not been particularly influenced by their political traditions in their reaction to the pandemic because, in such a crisis, the style of governance changes. Governments can act faster and more effectively in times of crisis, especially when they rely on their governmental structures (vertical and horizontal fragmentation) and their administrative capacities which must be effective to move from their administrative routine tasks to quick decisions under uncertainty (Jugl, 2022). One of the important features that was broadly common to many countries was the decentralization of power, assigning

responsibilities to state, regional and local levels. Large cities also began to establish themselves as key players alongside national governments. During the first wave, the biggest part of government responses in the world was lockdown; the difference was more marked in the following waves, where the severity of the restrictions applied depended on each country (Anttiroiko & Arto, 2022).

Belgium is no exception to these two features: there is indeed an increase in the transfer of power between federal and federated entities (Clarenne & Romainville, 2020). Due to the desire to react correctly to the evolution of the disease, lockdown restrictions and control measures were also first required. On March 18, 2020, total lockdown was enforced by the Belgian government. It will last 2 months, before a progressive end of lockdown is announced. During the months of May, June and July, shops are gradually authorized to reopen, teaching takes place in a hybrid way (face-to-face and remote), the Belgian borders open again and, lastly, the catering sector takes its activity back. In addition, the Belgian government implemented several measures like social distancing, mandatory use of face masks, curfew, testing facilities and contact tracing teams. The rest of 2020 and 2021 were then marked by the alternation between relaxation and the reintroduction of restrictive measures according to the different phases of the epidemic. In January 2021, a vaccination campaign against Covid-19 began, with a sanitary pass (Covid Safe Ticket) authorizing certain social activities accessible only to vaccinated people. Finally, in March 2022, the government lifted most of the restrictive measures and declared the non-use of the sanitary pass (*Dernières nouvelles | Coronavirus COVID-19*, s. d.)

The situation was not easy to manage: the Belgian government had to deal with both the health crisis and the reaction of people to the measures they were imposed. Indeed, many objections have been raised to the very restrictive life measures, and especially to the adoption of the rule of the compulsory health pass which are considered as obstacles to fundamental human rights (Bouhon, 2022; Bouhon et al., 2020). The most convincing weapon for maintaining these guidelines and positively influencing the population to respect them was to appeal to people's sense of individual and collective responsibility (Renaud et al., 2021). This injunction of adherence to these government measures went through public awareness campaigns and transparent communication with the population about updates and recommendations, with mixed results in a number of cases: studies carried out among populations, notably in France, Germany, Italy and the United Kingdom, affirm that confidence in the government in the management of the crisis was evident at the beginning of the epidemic, to become mixed as it progresses, and even bad in France (Algan & Cohen, 2021; Hassenteufel, 2021; Sliman, 2021). One can imagine that this drop in confidence may be due to a growing weariness of ever more restrictive measures, especially among young people (Sliman, 2021).

1.3 Impact on firms and on global economy

Following all the restrictions implemented by the government, the business world has been largely impacted by this sanitary crisis. From one day to the next, working can seriously harm everyone's health. The risks of the disease are everywhere, which means that the vast majority of the people had to suddenly stop working (Cianferoni, 2020).

This brutal two-month lockdown and the restrictive measures that followed have had a significant impact on firms across various industries and sectors. Numerous businesses experienced a decline in demand for their products and services. Lockdown measures, reduced consumer spending, and economic uncertainty contributed to lower sales and revenue: if the largest sales drop is reported by firms in mid-2020, large sales losses continued to exist in 2021 (Bloom et al., 2021). In addition, the Covid-19 pandemic has hugely impacted the equity market and most stock indices worldwide have experienced a fall, which also caused a notable decrease in share prices and revenues for a certain

number of listed companies (Baker et al., 2020a, 2020b; Bose et al., 2021; World Economic Forum, 2020). Overall economic growth is also affected by the situation: in 2020, Belgian GDP experiences a drop of around 8%, as well as a marked slowdown in growth for some of its components in 2021, such as private consumption, public expenditure, and investment (Belga & Belga, 2020; BNP, 2022), while world GDP is experiencing a decline of about 3% (IMF, 2021; Heyer & Timbeau, 2022). With these measures and these severe slowdowns in the economy, the increase in unemployment and poverty was inevitable (Ronaghi & Scorsone, 2023).

Many firms also faced disruptions in their supply chains. The Covid-19 pandemic spread in China and other Asian countries, which are major countries for the production and export worldwide of goods of all types. With travel restrictions, temporary closures of factories and production facilities and border closures, many flaws in supply chain processes have been revealed (Sharma et al., 2020). In the past, there have been many other disasters on the Asian continent, including the 2011 earthquake in Japan, the 2003 SARS outbreak in China, and the 2004 tsunami in Indonesia, which also caused a halt in production and exports. (Kraude et al., 2018; Pokharel et al., 2020; Tan & Enderwick, 2006). But in the case of the Covid-19 crisis, there is the factor of uncertainty: the economy is almost completely shut down for an indefinite period, which may be much longer than expected (Pokharel et al., 2020). Companies had to review their systems trying to perform with these vulnerabilities and find alternatives, the main problem being to avoid supply chain dependencies (Sharma et al., 2020; Shokrani et al., 2020). This led to delays in all deliveries: coupled with the decrease in worker availability and productivity, due to exposure to the virus, it was a real challenge to maintain the activity alive (Aday & Aday, 2020; De Sousa Jabbour et al., 2020; Pamidimukkala & Kermanshachi, 2021).

Financial strain and uncertainty due to the economic downturn were also challenges for firms during these times of pandemic. The risks become higher, and companies may face cash flow issues: their ability to increase and dispose of their cash holdings in this kind of emergency is challenged (Shen et al., 2020). A lot of companies are struggling to collect enough cash inflows to be able to cover their expenses, and the risks of not being able to correctly ensure the balance between the receipt of payment of receivables and the payment of payables are high, which increases the risk of bankruptcy, poor financial health, inventory issues and long-term losses (Jiang et al., 2021). With this uncertainty, managers' investment policies are reconsidered, and investor behavior is much more instable and much less inclined to risk tolerance (Shen et al., 2020; Wang et al., 2021). Difficulties in securing loans or investments affect business operations and long-term planning. To help companies keep their head above water, governments around the world implemented various support measures to assist businesses during the pandemic, with their availability and effectiveness varying by country and region; these included financial aid packages, tax relief, loan programs, and wage subsidy schemes (Union Wallonne des Entreprises, 2020).

All firms had the necessary and immediate need to adapt in response to the challenges posed by the pandemic. The effects of the crisis are not the same for all sectors. Some have recorded a greater drop in performance than others: among them, in a non-exhaustive manner, the catering sector, tourism, arts and entertainment, manufacturing, retail, all sectors that require a physical store or face-to-face contact (Lu et al., 2021; National Bank of Belgium, 2021). A difference in performance drop can also be noticed between online and offline companies (Bloom et al., 2021). Most of businesses have been forced to turn to innovation: for example, companies shifted to remote work models, implemented new delivery methods, or repurposed their operations to produce essential goods and services, have implemented digitalization. Innovative companies possess dynamic capacities for attention and understanding, which makes them more flexible, and flexibility can be a key factor in adapting in such a crisis (Eggers & Kaplan, 2009, Helfat et al., 2007; Krammer, 2022).

2. Firm performance and crises

2.1 Financial and non-financial crises experienced in the past

The major global financial crises are major events that have had significant economic repercussions on a global scale. They are often characterized by widespread failure of the financial system, significant declines in stock markets, a contraction in credit and negative repercussions on the real economy. In this thesis, we develop research on the impact of the latest global crisis, the Covid-19 pandemic, on business performance. It is therefore important to learn through the literature on previous crises, their impact on companies as well as the way in which companies have managed to overcome or not these crises.

Economic crises are very diverse in terms of the markets or institutions they affect. The literature predominantly separates crises of a financial nature and crises of a non-financial nature. Boyer et al. (2004) considers the notion of financial crisis limited to financial markets and financial intermediaries, namely the banking crisis, the currency crisis, and the stock market crisis. According to these authors, other crises become financial only when they begin to have an impact on financial markets and intermediaries, which is not always the case. Marouani (2013) agrees with this theory by adding that a crisis is considered financial when the allocation of credit and capital, the circulation of means of payment and/or the valuation of financial assets experience disruptions. Some financial crises are even known in the literature as twin financial crises, which means that they involve both the banking sector and exchange rates (Boyer et al., 2004; Miotti & Plihon, 2001). But whether crises are financial or non-financial in nature, they can quickly spread to the entire global economy (Bricogne et al., 2009). However, the Covid-19 crisis that we are studying here is a global and generalized crisis affecting almost the entire world economy and is not the result of a malfunction of the economic system itself but of an external event (Ajili, 2020). For this reason, we will study in this section the main major financial and non-financial crises that have spread to the global economy, in order to have a complete understanding of all kinds of phenomena.

2.2 Financial crises

2.2.1 The Great Depression (1929)

The global financial crisis of 1929, also known as the Great Depression, was one of the most devastating economic crises in history: due to this dark period, the year 1929 has become legendary (Galbraith, 2011). It started in the United States and quickly spread across the world, with disastrous economic consequences for a decade. Since 1927, the United States had experienced great stock market euphoria: investing in the stock market had become the flagship activity of the American population to enrich themselves, which enveloped them in a bubble made up of excessive speculation and massive indebtedness (Hammouda & Sadni-Jallab, 2008; Rappoport & White, 1993). No economist, businessman or politician predicted an end to this flourishing period and assured that investing astronomical amounts in the stock market would lead to wealth (Boutillier, 2013).

However, the market crashed, and the bubble exploded: many investors lost their savings and banks began to fail, because they had granted loans to finance these speculations, leading to a crisis in the banking system (Hautcoeur, 2018; Romer, 1990). The crisis began on October 24, 1929, known as "Black Thursday", when the stock market on Wall Street in New York crashed. Panicked investors began to sell off their shares in droves, causing stock prices to plummet. The stock market crash continued for the next few days, culminating on October 29, "Black Tuesday", with another day of panic and massive selling. According to Galbraith (2011) in his book dedicated to the economic crisis of 1929, "Tuesday October 29 was the most devastating day in the history of the New York Stock Exchange".

Although it was essentially a stock market crisis, the economic consequences of the 1929 crisis were catastrophic: purchasing and credit power were extremely reduced, unemployment reached very high records and especially in the middle class, industrial production dropped drastically, factories closed (Claudel et al., 1993; Garbagnati, 2008). The term economic depression is beginning to be raised. Farmers also suffered greatly, experiencing an agricultural crisis. Some agricultural sub-sectors had already recorded phases of decline in previous years and, with this crisis, overproduction and falling prices of agricultural products have led to significant losses (Béaur, 2021).The depression quickly spread to other countries, as the global economy was interconnected: countries that depended on exports were hit hard as global demand collapsed and protectionist policies, such as the introduction of customs tariffs, have also contributed to aggravating the crisis by restricting international trade (Lambelet, 2011).

Governments have tried to set up economic stimulus measures to mitigate the effects of the crisis, but the results have been mixed. The 1930s were marked by persistent economic deterioration, rising unemployment, and prolonged deflation (Lewinsohn, 1934). It was not until the outbreak of World War II in the 1940s that the crisis began to unwind, as wartime spending stimulated the economy and created jobs, making the crisis of 1929 a landmark event in economic history over a decade (Henry, 1999).

2.2.2 The Asian financial crisis (1997)

The Asian financial crisis of 1997, also known as the "Asian crisis" or the "Asian financial crisis of 1997-1998", was one of the most destructive economic crises in recent Asian history, involving failures of financial and macro-economic systems (Cartapanis et al., 1998). It started in Thailand in mid-1997 and quickly spread to other countries in the region, causing a major economic recession and a significant impact on the global economy. Before the crisis, Asian countries such as Thailand, Indonesia, South Korea, the Philippines, Malaysia, and others had experienced a period of strong economic growth, attracting massive foreign investment: the situation was considered by economists as "the miracle of East Asia" (Imai, 2003). These Asian countries, notably Thailand, had accumulated high debts due to misguided investment projects, loose monetary policies, and rapid credit expansion. This situation has led to an overvaluation of assets, particularly the real estate sector (Graham et al., 2000).

The trigger for the Asian crisis was the devaluation of the Thai baht in July 1997. The Thai government was forced to float its currency after depleting its foreign currency reserves while trying to maintain the parity of the baht against the US dollar. Investors began to detect the weakness of certain economic sectors as well as the massive indebtedness and began to lose faith in Asian's economic stability (Lahet, 2009). They quickly withdrew their investments from Thailand first, and then from the other Asian countries, causing massive capital flight (Lahet, 2009). From that moment on, the crisis becomes more than a simple currency crisis, and begins to cause a financial crisis and a crisis of growth which spread to many other dimensions of the economy (Hugon, 2001). To qualify this crisis, Barais and Bates (2004) speak of "mechanical contagion", through the ties of dependency between countries, and of "psychological contagion", to show the instability of the behavior of external creditors.

The Asian crisis had devastating consequences on economic activities for the countries affected. Unemployment and poverty increased a lot, living standards plummeted, many businesses went bankrupt, and the banking sector was badly affected (Ramesh, 2009). The governments were forced to make major economic reforms to restructure their financial system and the International Monetary Fund (IMF) has been called upon to provide emergency financial assistance, but this has often been accompanied by harsh austerity measures and economic reforms imposed by the institution (Ramesh,

2009; Yoon, 2010). This crisis has also had an impact on the global economy due to the growing interconnection of international markets and the general loss of confidence in emerging markets from foreign investors (Mourougane & Prigent, 1997).

2.2.3 The subprime crisis (2007-2008)

The 2007-2008 crisis, also known as the "global financial crisis" or the "great recession", was a severe economic crisis starting from the United States: it has been called « the second great contraction » by economists, after the Great Depression of the 1930s (Esposito, 2013; M & M, 2010). It quickly spread globally, causing a major economic recession and a profound impact on international financial markets (De Rosa et al., 2010).

De Rosa et al. (2010) also explain that the crisis of 2007-2008 was largely caused by a combination of complex factors. First, there were macro-economic factors, as international financial imbalances, and micro-economic factors, as the growth of risky mortgages in the United States when many US lenders had begun to provide subprime mortgages to borrowers with poor credit, often without properly verifying their ability to repay those loans.

In 2007, the US housing market began to slow, leading to higher default rates on subprime mortgages. Investors lost their trust in mortgage-related assets, due to their lack of liquidity and uncertain value, which quickly caused a crisis of confidence in global financial markets (B. Grusky et al., 2011). Banks began to fear that other financial institutions, all this situation making them financially vulnerable ((Gertler & Gilchrist, 2018). The crisis has spread through the global financial and economic system. Love and Mattern (2011) and P. Jenkins et al. (2013) identified the severe consequences: banks, insurance companies and other financial institutions suffered massive losses, leading to some costly bankruptcies or government bailouts to avoid the complete collapse of the financial system. Unemployment rose significantly, and the value of financial assets dropped dramatically. Real estate markets collapsed in many countries.

The crisis spread to many other countries in the world but did not hit all economies in the same way: the economies most affected were the economies of developed and advanced countries, developing countries being less integrated into the global economy (Verick et al., 2022). In the face of the crisis, governments and central banks have taken extraordinary measures to stabilize markets and rescue struggling financial institutions: massive liquidity injections from the states have been made, revision of the principles of monetary regulation, redefinition of the role of the institutions and reduction of the interest rates to stimulate the economy (De Rosa et al., 2010; Verick & Islam, 2010).

2.2.4 The European sovereign debt crisis (2010-2012)

The European sovereign debt crisis, also known as the "euro crisis" or "euro zone debt crisis", started in 2010 and was a significant economic crisis for the European Union. It affected several eurozone countries, seriously affecting their economies and the stability of the eurozone as a whole.

The European sovereign debt crisis began with the revelation of serious debt problems and budget deficits in some eurozone countries, particularly Greece. Lane (2012) identified several risk factors that may have caused the crisis in several countries such as Greece, Italy, Spain, Portugal, and Ireland: in particular, following the creation of the euro in the mid-2000s, the increase in public debt and private debt, large financial imbalances, as well as failures to maintain effective fiscal policies following

growing borrowing. Indeed, for these countries, international borrowing became easier and more attractive since the currency was now the same (Lane, 2012).

When investors realized the magnitude of the public debt and the risks of default, they started demanding much higher interest rates to lend money to these countries or even reduce their loans or withdraw from certain markets altogether (Constancio, 2016). This resulted in a downward spiral for the affected economies. Troubled countries have faced difficulties in refinancing their debt and the European Union, together with the International Monetary Fund (IMF), created several bailout and financial rescue programs for troubled countries, in exchange for the implementation of economic reforms and austerity (Schadler, 2013). But these, unpopular, did not produce a positive response from the countries concerned and had a negative impact on economic growth and employment (Kosmidou et al., 2015). The European sovereign debt crisis also had repercussions on the global economy and highlighted the vulnerabilities of the European monetary system, leading to a reassessment of economic, monetary, and social policies within the EU (De La Porte & Heins, 2016; Sandbu, 2017).

2.3 Non-financial crises

2.3.1 The First and the Second World War

World wars are major economic crises because of their devastating impact on the global economy when peace returns. In addition to the loss of millions of human lives, the post-war world had to face appalling economic consequences: numerous material damages, breathless production, enormous war debts to be repaid and monetary inflation (Mantoux, 2002; Michael, 2007). There is also a difference of opinion among authors as to the classification of world wars as economic crises or economic rescues: some consider that war creates employment and stimulates the economy, and others believe that war is synonymous with massive destruction and enormous losses (Mantoux, 2002; Michael, 2007).

2.3.2 The Oil Crisis (1973)

The 1973 oil crisis, also known as the "first oil crisis" or the "oil shock of 1973" was an economic crisis that led to a sharp and dramatic increase in the price of oil and major economic consequences around the world.

It was triggered by a series of geopolitical and economic events: in particular, the Israeli-Arab Yom Kippur War, where the United States gave its support to Israel, and the oil embargo of Arab oil-producing countries against the western world, in retaliation for supporting Israel (Antonin, 2013). This oil embargo causes an energy crisis leading to a global economic crisis, because of the meteoric rise in the price of oil. This oil embargo is seen by the Americans as a betrayal, causing tensions in the relationship between the United States and Arab countries, as well as in the relationship between the United States and certain European countries (Raymond-Viden, 2009).

Regarding the economic consequences, besides the shortage of oil caused by the embargo, the increase in the price of oil caused an increase in production and transport costs, which led to an increase in inflation in many countries, as well as an economic recession, an overall deterioration in public finances and an increase in the unemployment rate (Schramm, 2023; Warlouzet, 2017). In response to the crisis, many countries adopted energy-saving policies and sought to diversify their sources of energy supply, including alternative energies, thus helping to shape global energy policies in the following years (Alpanda & Peralta-Alva, 2010; Graetz, 2011; Levi, 2014; Rüdiger, 2014).

3. How can these financial crises result in poor performance and bankruptcies?

The principle of studying all these crises, with their causes and their consequences, is to be able to link them to the Covid-19 crisis and to be able to determine their common points; in particular, initially, in relation to the reasons why these crises end up in enormous economic problems, decrease in financial performance and even in bankruptcy for many companies. The ultimate goal of this literature review is to be able to determine, thanks to the knowledge of the history of all these crises and the way in which they cause economic and financial problems, factors allowing companies to cope with these crises. We will begin, in this section, by understanding how all these crises have the same economic outcome which, at first glance, seems inevitable.

Above all, it is important to understand that a company's financial performance is a crucial factor in its long-term health and survival. Actually, poor financial performance can lead to business failure. The concept of performance is a very complex concept to define because it contains many dimensions; however, it is very often used both in the literature and in practice to designate a certain level of excellence (Issor, 2017). Bourguignon (1998) admits three main dimensions of performance: the action itself, the result of this action and the eventual success of this action. By this multi-dimensional concept, he suggests that the study of a company's performance cannot be reduced to just one of its dimensions, such as financial performance, which often represents the chosen performance study angle. However, in the context of this thesis, we will mainly consider the performance under its financial aspect: according to Nurhayati et al. (2021), the main purpose of a company's financial performance is to create firm value and maximize it for all its stakeholders. It is measured by its ability to reach financial, operating, and strategic objectives. The greater the financial performance of a company, the more investors will notice its good financial health and the more the company will gain in value (Nurhayati et al., 2021). However, there are many factors caused by economic crises that can lower, slow down or even extinguish the financial performance of companies, considerably increasing the risk of bankruptcy. Through the economic crises studied above, we may be able to draw common economic or financial factors, whether external and global or specific to companies: these factors may have a huge impact on the health of the economy and, indirectly, on the risks of bankruptcy for firms.

First of all, it is important to study the global economic factors that can imply a decrease in performance, starting with a good understanding of the notion of economic crisis. In the literature, many authors have studied the subject and developed theories around economic cycles, looking for crisis factors. Marx (1894/1999) argues that his theory of the downward trend in the rate of profit creates a climate conducive to periodic economic crises by contributing to the contradictions of the capitalist system. According to Keynes (1936), economic crises are the result of a lack of sufficient aggregate demand in the economy, which leads to underemployment of productive resources, especially labor. He also highlights the importance of government intervention to stimulate aggregate demand and foster an economic recovery. Fisher (1933) and Minsky (1982/2013) put forward financial factors: according to Minsky, the crisis arises when the economy is subject to periods of financial instability, due to the evolution of the financial behavior of economic agents over time, while Fisher puts forward the excessive accumulation of debts which can lead to a deflationary spiral.

Although all these authors identify different causes, their general definition of the crisis is common and lies in the following observation: a crisis corresponds to the moment when the imbalances of the system destroy this same system and cause violent damage (Dubar, 2011). Sinapi et al. (2010) also identify another common point in the theories of these authors: the crisis cycle starts in a system where an excess of optimism reigns, favored by a mimetic behavior of the components of the system. This theory can also be confirmed by the history of crises studied in the previous section. Indeed, all these crises begin with a period of strong economic growth, where all actors trust common beliefs, imitate each other in their search for profit and take too many risks. Reinhart and Rogoff (2009) qualify this with the phrase "This time is different", which is the title of their book, arguing that the mindset

of excessive euphoria behind it inevitably leads to rupture. However, this is not the case with the Covid-19 crisis, which at this level is more akin to the oil crisis: the breakdown of the system is due to an external event independent of the economic world, i.e., an exogenous shock (Ajili, 2020). To support these theories, Tremblay (2000) succeeded in identifying the five classic stages of the development of a financial crisis:

- Initially, a nation embarks on the accumulation of an external debt that significantly surpasses its GDP.
- Subsequently, the influx of monetary resources fails to suffice for covering its outbound monetary flows.
- This predicament of financial instability gives rise to skepticism and erodes investor confidence, leading to divestment, debt liquidation, and exchange rate devaluation.
- In the aftermath, banks experience a surge in interest rates as a desperate attempt to extricate themselves, thereby precipitating economic and financial repercussions.
- Ultimately, the devaluation of the exchange rate contributes to escalated costs of foreign debt, culminating in the insolvency of local borrowers, such as corporations or financial institutions.

Another important factor of economic recession, and which is common to all types of crises, is the phenomenon of contagion. Constancio (2016) defines the phenomenon of contagion as the process by which financial instability has such a wide reach that it generates a crisis in all components of the system. According to Calvo and Reinhart (1996), two types of contagion can be raised: contagion linked to the herding behavior of investors and contagion linked to specific chains of transmission such as trade, finance, technology, and others. Some literature discusses these chains of transmission, in a way that corroborates the phenomenon of contagion emerging from each economic crisis. Kaminsky and Reinhart (2000) identify three chains of transmission that can propagate contagion in the economic world: common bank creditor; liquidity channels, mutual funds, and cross-market hedging; and trade links among countries with bilateral trade or competition in third markets. Indeed, as explained by Kaminsky and Reinhart (2000) and as highlighted in previous crises, the behavior of institutional investors can be crucial in the unfolding of a crisis, as they may call loans and refuse to provide new credit to the crisis countries when loans are deemed non-performing. In addition, trade links between countries are also conducive to contagion, due to the importance of import and export and due to price or income effects on one country if the other is affected by crisis. And with regard to liquidity channels, mutual funds, and cross-market hedging, Kaminsky and Reinhart (2000) argue that banks are not the only lenders. Portfolio flows are important and can contribute to contagion in the event that equity and bonds are internationally traded. Fratzscher (2003) takes up these same factors and classifies them into two types of interdependencies: financial interdependencies and real interdependencies. He also adds that shifts in investor beliefs can also be contagion factors, which corroborates the theories of Calvo and Reinhart (1996) and Calvo and Mendoza (2000) according to which the globalization of financial markets pushes investors to favor common investment strategies and thus, greater spread of contagion.

In addition, authors point out a general climate of economic uncertainty in times of crisis, which can have a huge impact on business investment decisions. Indeed, the nature of the investments is irreversible: once the amounts have been invested, it is very difficult to recover them, which explains why in times of crisis, uncertainty and risk, companies remain very cautious in terms of investment policy (Blot et al., 2009). Bloom (2009) constructed a model to measure the impact of uncertainty shocks. According to him, the increase in uncertainty is causing companies to halt their investments and hiring, which causes a drop in productivity, demand, and income.

The literature also defines the concept of hysteresis, to explain the long-term effects of the consequences of a situation even when this situation is over (Grjebine & Tripier, 2017). This concept was raised to talk about the consequences of economic crises, notably by Blanchard and Summers (1986) and Blanchard et al. (2015). They first explain in their first work that this hysteresis is present

for the high degree of the persistence of unemployment over the previous century. Then, in their second work, they explain that permanent unemployment leads to changes in the behavior of companies, such as less investment and research following periods of recession, which causes a drop in productivity and economic growth greater than if the crises had never occurred.

Let us now focus more on the factors of an economic or financial nature that can lead to the bankruptcy of companies when the crisis has already set in. Numerous works of literature identify key factors which, during an economic recession, can lead to financial insolvency: in general, it is the combination of all these factors that considerably increases the risk of bankruptcy. To begin with, many authors point out in their research the impact of demand reduction, especially Keynes (1936), as mentioned earlier, in his theory of effective demand. He explains that a drop in demand can lead to overproduction, price crashes, and lead to periods of involuntary unemployment, which affects business sales, creates additional costs, and reduces revenue. He is not the only one to identify demand as a determining factor: other post-Keynesian growth theories have been developed, providing nuances but always considering the significance of the decline in economic demand (Bellais, 2004; Dutt, 2001; Kregel, 1988). In the same spirit, possible supply chain disruptions, a phenomenon that could be noticed during the Covid-19 pandemic, are also slowing sales, which impacts revenue (Sharma et al., 2020). Overall, in times of economic and financial crisis, a significant slowdown in activity affects households, businesses, and jobs: this affects the entire real economy (Journal official de l'Union Européenne, 2009). The collapse of financial markets leads to significant losses for companies dependent on investments or stock market trading, and forces banks to apply a credit crunch, resulting in more limited access to finance and higher financing costs. This can aggravate the cash flow problems of already indebted companies (Blot et al., 2009; Journal official de l'Union Européenne, 2009). Economic crises lead to a phase of overall loss of value. The phenomenon of asset depreciation is also often pointed out. Financial crises can lead to a depreciation of assets held by companies, such as real estate, inventory, or investments, which reduces the net worth of companies.

All these non-business and external factors can significantly increase the risk of bankruptcy. However, business-related, and internal factors should also be considered: the financial characteristics of companies can aggravate the crisis situation if they are already weak or in decline even before the crisis arrives. Many authors discuss in their books the importance of strong financial characteristics to enhance firm performance. More particularly, the weak financial resilience of companies in times of crisis is pointed out. According to Salignac et al. (2019), financial resilience can be defined as the ability of an individual or a company to withstand stressful life events that affect their income and/or assets. They present a financial resilience framework along four dimensions: economic resources; financial products and services; financial knowledge and behavior; and social capital. From these dimensions emerge many financial characteristics that can help maintain performance, including the ability to pay one's debts, an underlined factor in the history of many crises. The OECD (2017) argues in one of its books on the economic outlook that an increase in corporate indebtedness can be observed in times of crisis. This explains why even if the debt is important for the financing of investments and for the general productivity of companies, too high a level of indebtedness can lead to a lower capacity of financing for their investments, a drop in competitiveness and an exacerbated vulnerability to economic shocks. Excessive indebtedness over a long period can also increase the risk of becoming a "zombie" company (Banque de France, 2022; OECD, 2017). Companies can be qualified as zombies when they are mature companies (more than 10 years old) for which profitability does not cover interest charges for at least three consecutive years (A. McGowan et al., 2017; OECD, 2017; Ophèle, 2021). Zombie companies not only have a much higher risk of bankruptcy due to their non-performance and non-productivity, but also damage the entire economy by impacting non-zombie companies (Wilbur, 2018). Ophèle (2021) therefore highlights the importance for companies to strengthen their financial characteristics in order to better manage the risks of insolvency and bankruptcy, especially in the case of highly indebted companies before and during crises.

4. Financial characteristics that can help firms to maintain their financial performance and overcome these crises

The continuity of this literature review brings us to the most important point concerning the theoretical part, because it is in this section that we will approach the factors related to the financial characteristics of companies that can be decisive in the maintain of a good financial performance during crisis times. We already explained that strong financial characteristics are essential to ensure financial health and optimal corporate decisions. According to Gao et al. (2021) and Duho (2021), the most important decisions related to the financial responsibilities of managers which can have a significant impact on the future financial health of the company are respectively capital structure decisions, operating liquidity decisions and investment decisions. These financial characteristics may make it possible to better manage the risks of insolvency and bankruptcy, enhancing performance. We will therefore study each of them and understand how they can help in overcoming crises.

4.1 Capital/Financial structure

We will begin by defining the notion of financial structure. Altan and Arkan (2011) give in their work a definition of the financial structure of a company. According to them, the financial structure of a company refers to the way in which it is financed, i.e., the combination of the different sources of financing that it uses to support its activities and its investments: in other words, this term refers to the combination of liabilities and equity used by a company to finance its assets. They advance that this structure is essential to understand how the company is able to manage its debts, assume financial risks and create value for its shareholders: in other words, the financial structure is fundamental for the performance of a business and consider some principles such as compliance, cost, risk, flexibility, share of management and timing. It is common to use the terms financial structure and capital structure to define the same concept, although some authors differentiate between them by stating that capital structures cover only long-term sources of funds, while financial structures encompass all liabilities (Surbhi, 2018). The main goal is to obtain the optimum financial structure to maximize the market value of the firm (Altan & Arkan, 2011). Van Caillie (1997) completes this definition by adding the notion of investment. He explains that investment plays a driving role in the activity of any firm, and that each investment must be financed by internal or external financial resources. According to him, the notion of internal and external financial resources being directly linked with the definition of financial structure, the choice of an appropriate financial structure is therefore necessary for the functioning of a company's activity. But what does the concept of optimal financial structure really mean? In the literature, many authors have developed theories to approach this notion, and it is important to properly integrate each of them in order to understand how the financial structure of a company is essential to its performance.

One of the first important theories on this subject was developed by Modigliani and Miller (1958), in their work on the structure of capital: “The Cost of Capital, Corporation Finance and the Theory of Investment”. They demonstrate in this theory that the financial structure of a company does not affect its value and that, therefore, there is no optimal balance between debt and equity, which means no optimal financial structure. They develop this theory by making assumptions of perfect financial markets, that is to say:

- All economic agents, individuals or companies, act without discrimination taxes under a common risk-free interest rate.
- Bankruptcy costs do not exist.
- The market efficiency hypothesis is rigorous, i.e., there is no information asymmetry or agency costs.
- There are no taxes or transaction costs.

Under all these assumptions, Modigliani and Miller (1958) therefore explain that the value of a company is totally independent of the structure of the liabilities used. However, after the publication of this article, many authors have challenged this theorem, in particular because this neutrality of the financial structure is only valid under the assumptions of perfect financial markets, which does not reflect at all the economic reality full of imperfections. Therefore, Modigliani and Miller have themselves developed a new approach that qualifies their first theorem by including the fiscal factor of taxes and corporate taxation. In this new theory, Modigliani and Miller (1963) explain this time that a company with debt has a greater value than one without debt, and that a company with maximum debt could greatly benefit from the tax advantages following the deductibility of interest on debt. Following these theories of Modigliani and Miller (1958, 1963), many works began to discuss capital structure, gradually relaxing the assumptions of perfect financial markets and incorporating bankruptcy, transaction and agency costs, information asymmetry as well as fiscal parameters. A few theories stand out, invalidating the theory of neutrality of the financial structure and admitting the existence of an optimal financial structure.

Jensen and Meckling (1976) develop the "Agency Theory" in which they consider the consequences of conflicts of interest between economic agents, especially within the same institution, under imperfect market conditions. They explain that apprehending the issue of the financial structure as only the balance between debt and equity is insufficient, and that it is also necessary to include all the internal and external economic agents linked to these quantities of debt and equity. They therefore consider in their theory the agency costs and explain that an optimal financial structure can exist if the implications of the different agents are considered according to the agency costs. Another theory has also been raised, the "Trade-off Theory", which implies that an optimal financial structure can be established on the basis of a compromise between the advantages and the costs of indebtedness (Adair, 2014). Kraus and Litzenberger (1973) explain that the benefits of indebtedness are related to tax benefits, and that the costs of indebtedness refer to the costs of bankruptcy because the increase in debt increases the risk of bankruptcy. According to them, the optimal financial structure is reached when the benefit of an additional unit of debt is equivalent to its cost (see graphic appendix). Often, agency fees are also included in this theory (Adair, 2014). Myers and Majluf (1984) also worked on another theory, called the "Pecking Order Theory". This theory is based on the existence of an asymmetrical sharing of information between internal agents (managers) and external agents (investors) in the company. This theory calls into question the existence of an optimal financial structure because, in this case, companies do not necessarily have to reach an optimal level of debt, but rather a hierarchical choice of optimal financing determined by the level of information asymmetry (Adair, 2014). Myers and Majluf (1984) establish this hierarchical order of financing as follows: a company will first prefer to finance itself by its internal cash flow in self-financing, then by debt, and in the very last case by the sale of shares, therefore by increasing its capital.

All these theories explaining the concept of financial structure in depth generally converge on a hypothesis of the desire to achieve maximization of the value of the company (Van Caillie, 1997). This can allow us to think that the financial structure of a company is directly linked to its value. In this thesis, we are mostly interested in the financial structure of companies in order to identify its role in maintaining financial performance in times of crisis. It is therefore important to understand how the financial structure of a company and its financial performance are linked. Previous research has allowed us to establish that decisions related to the financial structure of the company aim to minimize capital costs and maximize the value of the company (Rao et al., 2007). The financial performance of a company and its financial structure are therefore two interdependent concepts that have a reciprocal influence, both pursuing the goal of maximizing the value of the company. Strong financial performance can influence a company's decision to use more leverage, while a well-balanced financial structure can help support sustainable financial performance (Ahmed et al., 2023; Nurhayati et al., 2021; Sudiyatno et al., 2012). Many studies focus on the relationship of influence between the financial structure and the performance of a company. Berger and Di Patti (2006) established a model that

attests to the favorable relationship between the financial structure of a company and its performance, by proving that an increase in the Debt-to-Equity ratio led to an increase in the performance of the company. Other authors have also noticed a positive influence of financial structure on company performance (Abdullah & Tursoy 2021; Jouida, 2018; Ngatno et al., 2021). However, Rao et al. (2007) highlights the fact that most of the work is carried out using European or American samples, and that it is also important to consider this relationship in the context of emerging countries. Indeed, their study shows that, unlike Western countries, the relationship between financial structure and business performance in Oman is negative. This result is corroborated by other studies, which show that leverage has a negative effect on profitability (Abor 2007; Li et al. 2019; Rayan, 2008; Salehi, 2009; Sheikh and Wang, 2013). If all these results are visibly in contrast, there is no doubt that a relationship between financial structure and financial performance exists (Ahmed et al., 2023).

4.2 Financial flexibility

We will now focus on the next important financial characteristic for the health of the company, considered fundamental in the literature of corporate finance: the liquidity. Liquidity refers to the ease with which a company can convert its assets into cash in order to meet its short-term financial obligations, such as debt payments, salaries, suppliers and other current expenses. It is essential to maintain financial stability and take advantage of opportunities that arise. In this section, we will explore another, broader and more complex way of approaching the concept of liquidity by introducing the concept of financial flexibility.

Financial flexibility means that a company "can avoid financial distress in times of negative shocks and readily fund investment when profitable opportunities arise" (Gamba and Triantis, 2008; Lester et al., 2021). However, financial flexibility and liquidity are two closely related concepts, but they are not identical. Financial flexibility refers to a company's ability to adapt quickly and efficiently to changing economic conditions. This implies the availability of liquid and strategic financial options to deal with unforeseen situations or to seize favorable opportunities. This therefore has an influence on the level of liquidity of a company, but it is important not to misunderstand the two notions. In a crisis, this concept is therefore relevant to develop and has even already been the subject of several studies. Teng et al. (2020), Yi (2020) and Arslan-Ayaydin et al. (2013) studied financial flexibility and characterized it as a significant factor in the strategic adaptation of companies. According to them, financial flexibility denotes the inherent robustness of companies to mitigate financial risks and efficiently employ financial resources when confronted with dynamic changes in the financial landscape, in order to better adapt and augment their financial capabilities. Enterprises with strong financial flexibility also obtain easier access to capital markets and can secure funding for new growth prospects, even in times of crisis, at reduced costs, which makes it an interesting factor for business owners and managers.

Financial flexibility cannot be measured in a single, universally accepted manner. Previous studies use either a single measure, multiple measures, or combinations of measures. The most used indicators are the level of cash holdings or financial leverage, whether used separately, together or in a combination method (Teng et al., 2020). But the most popular determinant remains the level of cash reserves, which is itself a widely debated topic in the academic community. Opler et al. (1999), like many old researchers, explain this concept by two theories already developed previously, this time derived from liquidity: the tradeoff theory and the financial hierarchy theory. On the one hand, the first theory suggests that there is an optimal level of cash reserves when the costs of maintaining cash equal the benefits, and on the other hand, the second theory denies the existence of an optimal level. optimal cash reserves. In this case, to deal with the asymmetry of information, companies will tend to maintain a reserve of cash to support the financing of activity and investments. Opler et al. (1999) as well as Kim et al. (1998) demonstrate in their research that the determinants of corporate cash holdings support the tradeoff theory. They demonstrate that firms with strong growth prospects, firms

with riskier activities, and small companies hold more cash than other firms. Tayem (2016) also shows that companies hold cash when they encounter higher transaction costs and high external costs of financing, which is consistent with the tradeoff theory. His study also shows consistency with financial hierarchy theory, as it shows a positive relationship between cash flows and cash holdings. He also adds, like previous authors, that companies that tend to hold more cash are smaller companies with more risk and more opportunities for growth.

Many researchers have also carried out studies on the impact of the level of cash reserves and the impact of financial flexibility, these two concepts being almost always linked, on the performance of companies. Lester et al. (2020) produced a working paper based on the impact of financial flexibility in the context of the pandemic and drew certain conclusions. In their study, they measured the financial flexibility as the high level of cash holdings and found that financial flexibility was a very important characteristic for companies during an economic recession by proving that the financial flexibility of companies with a good cost and governance structure attenuates the negative shock of the pandemic, even if it cannot be considered as the only mitigating determining factor. These results are consistent with the results of prior work on this subject. Fahlenbrach et al. (2020) also studied financial flexibility through economic shocks due to covid-19 and demonstrated that more financially flexible companies are less impacted at the stock level by revenue declines. Teng et al. (2021) also showed a positive impact of financial flexibility on overall business performance in Taiwan. Mikkelson & Partch (2003) studied the impact of large cash reserves on the performance of a sample of American companies. They found that companies with high and persistent cash holdings positively impact performance, which is evidence that cash holdings can improve a company's value. Other researchers have studied the impact of cash holdings on performance. La Rocca & Cambrea (2018), Doan (2020), Deb et al. (2016) and Iftikhar (2017) found a positive effect on performance of the accumulation of cash. Deb et al. (2016) also add that cash reserves improve performance when there is a need for adaptation, in a context of high competition, high research, or high growth opportunities. Iftikhar (2017) also admits that under uncertainty, cash reserves tend to increase, and that this liquidity can temporarily increase performance in times of crisis.

All this literature therefore leads us to believe that financial flexibility, approximated by the level of cash reserves, can have an impact on performance in times of uncertainty. In addition, Ma & Jin (2016) have developed research on financial flexibility that can greatly guide us on the next relevant factor to study. Their research focuses on the relationship between financial flexibility, financial performance, and investment and they found that financial flexibility has a positive impact on performance and investment.

4.3 Corporate investment

Following the lead of this latest study of Ma & Jin (2016), we will now focus on the last important financial characteristic identified at the start for companies: their investments. According to Van Caillie (1997), investment is the driving force behind the activity of any company: making investment decisions represents a key method by which companies generate value. According to authors, investment decisions are a strategic lever that allows a company to grow, innovate, improve its performance, and create value for all its stakeholders, including investors, employees, and customers. Careful and thoughtful management of investments is essential to ensure the long-term viability and success of the business. In fact, in the literature, what motivates corporate investment decisions is a major question for many researchers.

Until the end of the 1980s, the results addressed by the theories on the determinants of investment proved to be unsatisfactory: investment was simply linked to the growth of production or the rate of profit (Epaulard, 2001). One of these theories is the Accelerator Theory of Investment,

originally initiated by Clark (1917). The Accelerator Theory of Investment stipulates that investment expenditure increases when either demand or income increases. Jorgenson (1963) also developed one of the first theories, also called the Neoclassical Theory of Investment. Like the neoclassical theory of Modigliani and Miller (1958), this theory uses standard assumptions of perfect financial markets as no existing uncertainty, full perfect competition; maximum employment rate in the economy and the ability of firms to maximize the net present value of present and future cash flows. This theory uses the basic neoclassical production function and assumes that, for a given level of production, the company's investment will be all the lower as the user cost of capital is high relative to that of labor. In other words, this means that a decline in the price of capital will lead to an increase in the demand for capital services, and hence a rise in investment. Of course, since these models do not involve all the relevant determinants of investment, they have been widely criticized and have given rise to the emergence of new, more realistic theories, including other factors such as wages, rates of interest, future expectations. One of them is a well-known theory, the Q theory of investment developed by Tobin (1969), where the explanatory variable of investment is the positive function of Q, defined as the ratio of the market value to the replacement cost of capital. As a result, all the relevant expectations for firms are summarized in the value that the stock market assigns to their assets.

Lots of theories on this subject still exist, and all these theories and research aim to better understand the investment behavior of companies, and each contribute their stone to the building. The investment behavior of companies has also been studied in times of uncertainty, which is interesting in the context of our study. Blot et al. (2009) explains that the nature of the investments is irreversible: once the amounts have been invested, it is very difficult to recover them, which explains why in times of crisis, uncertainty and risk, companies remain very cautious in terms of investment policy. MacDonald and Siegel (1986) also studied this irreversible character. In their model, they define an optimal timeframe for the company to invest in a specific size project. Next, they demonstrate that when the uncertainty surrounding the investment project's earnings is high, the firm will require a higher current return from the project to engage in the investment. This leads us to believe that there is a relationship between a company's investment decisions and the climate of uncertainty, and that this factor is therefore also relevant in our study.

But how can these investment decisions affect a company's financial performance? Indeed, the irreversibility of investments under uncertainty can lead us to question the efficiency of these investments. As explored previously, investment is one of the drivers of the company's performance and increases its value: it is therefore natural to think that these investment decisions must be efficient to benefit to the company, especially in crisis times if their nature is irreversible. Investment efficiency directly refers to an optimal investment strategy. According to the neoclassical principle of Modigliani and Miller (1958), firms are advised to pursue projects that generate a positive net present value when discounted at the corresponding risk-adjusted cost of capital. As a result, companies will continue to invest until they reach their optimal investment strategy, when the return equals the cost of capital. However, in practice, companies very often deviate from this optimal investment strategy: they sometimes overestimate or underestimate certain projects, which leads to overinvestment or underinvestment. Duho (2021) is interested in the notion of overinvestment and underinvestment. According to him, a firm is underinvesting when the manager rejects investment opportunities with positive a positive net present value. Conversely, a firm is overinvesting when the manager takes on investment opportunities with a negative net present value. He also argues that companies that are overinvesting are often companies with high levels of cash holdings and low leverage, while the reverse is true for companies that are underinvesting. All the notions of overinvestment and underinvestment imply investment inefficiency (Knetsch, 2020). Much research suggests that this inefficiency is linked to asymmetry of information: in fact, higher quality information allows managers to identify better investment opportunities and thus involving investment efficiency (Biddle and Hilary, 2006; McNichols and Stubben, 2008; Chen et al., 2011). Others find other determinants of investment efficiency, as the role of managers or the ability to access external financing resources (Knetsch, 2020).

But what interests us in this specific case is the potential impact of investment efficiency on the financial performance of the company since, according to what we can extract from the literature, investment efficiency can be useful to the company in period of uncertainty. Several studies have been carried out regarding its impact on performance. Ma & Jin (2016) studied the influence of investment in their research on financial flexibility, financial performance, and investment. They demonstrated that investment efficiency had a positive impact on performance even though, in their study, investment scale had a greater impact than investment efficiency. Salehi et al. (2022) also found in their empirical results that investment efficiency has an impact on firm value. Chen & Lin (2013) have also shown in their research that reducing the degree of under-investment and over-investment can improve investment efficiency and have a better impact on firm value. Additionally, Fauziah et al. (2021) also proved that better investment exposure and efficiency improve firm value. In conclusion, the factor of investment efficiency is a relevant factor to take into account and may be likely to have a positive impact on performance in times of crisis.

4.4 Interconnections between factors and concepts

The development of these factors allows us it to return to a concept already developed in part in the previous section: the concept of financial resilience. As a reminder, financial resilience can be defined as the ability of an individual or a company to withstand stressful life events that affect their income and/or assets (Salignac et al., 2019). In fact, the capital structure decisions, the liquidity decisions, and the investment decisions are also closely related to the concept of financial resilience since they represent in a way the three pillars of the concept. The concept of resilience carries a meaning of strength, defense, resistance, agility, adaptation, and persistence: these notions are extremely important in times of crisis because the crisis affects the foundations of the financial function of companies and reinforces the problems related to their financial characteristics (Barzi & Bamousse, 2023). With good financial resilience, a company has all the assets to succeed in maintaining a good performance. According to Benhamida et al. (2023), financial resilience is based on 3 factors: strategic resilience factors, anticipatory resilience factors and structural resilience factors. Investment decisions are part of the strategic factors, considering the diversification of activities and opportunities. Capital structure decisions can be linked to structural factors but also to anticipatory factors through responsible and prudent debt as well as an appropriate choice of financing. Liquidity decisions relate directly to structural factors, given the importance of a flexible capital structure to successfully adapt. In other words, a balanced financial structure as well as prudent financial management, efficient investment decisions and adequate cash reserves imply good financial resilience, and good financial resilience can help sustain performance even when market conditions are tough. The interconnections between all these factors studied and all the financial concepts essential to the survival of companies in times of crisis make these factors essential elements to consider, in particular in the construction of the hypotheses of this master thesis.

5. External factors that can help firms to maintain their financial performance and overcome these crises

In addition to the financial characteristics specific to companies that act internally to try to maintain financial stability in times of crisis, it is also important to consider the financial characteristics that act externally to support performance. The term factor external to the company obviously refers to the government financial aid that is put in place, whether during the Covid-19 pandemic or during other previous economic crises.

Indeed, many authors who recount the various financial crises and comment on their economic consequences mention government interventions to mitigate the economic recession. DeRosa et al. (2010), Verick & Islam (2010), Yoon (2010) and Ramesh (2009) explain that after the economic crises experienced in the past, public institutions took measures at national, European, and international level, especially through monetary interventions by states to deal with the critical situations generated by the collapse of the major banks as well as by programs to review the principles of monetary regulation and redefine the role of financial institutions. However, these authors explain that all these measures put in place are not always unanimous among the countries. Indeed, Ramesh (2009) highlights the role of the International Monetary Fund (IMF) which, as we have seen through almost all crises, acts as an aid to fight against economic crises. International Monetary Fund is an international institution that helps ensure the financial and economic stability of its 190 member countries (IMF, 2023). According to Ramesh (2009), the IMF provides financial aid which helps countries to stabilize their critical financial situations but in exchange requires severe fiscal, monetary, and financial restructuring policies which, instead of helping, can contract the economy and aggravate the crisis phenomenon.

During the Covid-19 pandemic, the government was also not left out and provided numerous financial aids of all kinds to support companies in difficulty. Here is an overview of the various aids that have been provided (Union Wallonne des Entreprises, 2020):

- Direct financial aid: Grants and direct financial aid have been put in place to support businesses affected by the restrictions and closures linked to Covid-19. This support can take the form of non-reimbursable grants or loans on favorable terms.

- Deferral of taxes and social security contributions: To relieve the financial pressure on companies, governments have been able to grant deferrals of tax and social security payments.

- Partial or technical unemployment: Partial unemployment mechanisms have been put in place to allow companies to reduce labor costs without carrying out mass layoffs.

- Liquidity support: Measures aimed at improving businesses' access to credit have been put in place, such as loan guarantees or credit facilities.

- Bankruptcy moratorium: Some governments have introduced measures to temporarily suspend bankruptcy proceedings to protect vulnerable businesses during the crisis.

- Specific sectoral aid: Specific aid has been provided to certain sectors particularly affected by the restrictions, such as the tourism, catering, and event sectors.

- Rent reductions: In some cases, commercial property owners have been encouraged or forced to reduce rents to support tenant businesses.

Therefore, government subsidies are not a factor to be overlooked. In times of crisis, they are very present and can help keep companies afloat, mitigate the negative effects or at least avoid bankruptcy. Studies conducted on the impact of government subsidies on business performance are also rare and very little covered in the literature. However, some have still tackled it, even if the research is mainly based on Chinese companies. Liu et al. (2019) demonstrated that for a sample of new energy listed companies in China, government subsidies have a positive effect on firm performance. They also found some factors that influence this effect: the impact of subsidies is more positive when companies are located on the West Coast and when companies are non-state owned. Zhang et al. (2014) found as empirical results that government subsidies, in long and short terms, have significant positive effects on the financial performance of wind energy manufacturing companies. Jin et al. (2018) also showed in their study that government subsidies have a positive impact on private R&D investment and the performance of manufacturing enterprises. In other words, it has been proven that government subsidies can have a positive impact on business performance, and that they are very present in times of crisis. It is therefore an important factor to consider.

6. Summary of the literature and hypotheses development

As a reminder, the primary goal of this master thesis is to study the evolution of the financial performance of Belgian companies during the Covid-19 pandemic. More particularly, we focus on the development of hypotheses regarding the factors that could soften the negative effect of this crisis and prevent the decline in performance. Throughout this literature review, we have studied the negative effects of the pandemic, the context of other economic crises already experienced in the past, as well as the reasons why these crises cause a global economic recession and high risks of bad financial health for businesses, or even bankruptcy. We then looked at the financial characteristics of companies that could be useful in maintaining good performance, especially in times of crisis.

The first element that we can draw from this literature review is the very probable negative effect of the crisis. Through the context of the pandemic as well as other economic crises, we have seen that periods of crisis always have negative impacts on businesses. Although this research focuses a little more on the determinants of maintaining stable performance, it is also important to first assess the overall effect of the crisis on performance before looking at what could be causing its improvement. Therefore, our first hypothesis, which is our main hypothesis, is the following:

H1: The Covid-19 pandemic has a negative impact on the financial performance of Belgian firms.

We can then start from this overall negative impact hypothesis to be able to develop hypotheses on the factors that could mitigate this harmful effect. Based on the literature studied, we are going to develop 3 main types of hypotheses. First, we will study hypotheses on the financial factors, specific to each company, which could bring a positive effect to the performance internally. Next, we will focus on the context of the activity by developing a hypothesis on the sector factors. Finally, we will also study the factors external to the company which could bring some help, that is to say the governmental factors. In this way, we comprehensively study all types of potential factors and offer a complete view of the phenomenon. Regarding the internal financial aspect of the company, we learned through the literature that several financial characteristics could have a positive impact on performance and would be likely to improve it in times of health crisis: in particular the capital structure, financial flexibility, efficient investment decisions and financial resilience. In order to construct our hypotheses, we have decided to keep two of them: financial flexibility and investment efficiency. We decided not to study the other two factors, for the simple reason that there is already plenty of literature on capital structure, and conversely there is too little literature concerning financial resilience to rely on it. Our first two sub-hypotheses are therefore:

H2: When the financial flexibility of a firm is higher, the negative impact of the Covid 19 pandemic on this firm is less pronounced.

H3: When the investment efficiency of a firm is higher, the negative impact of the Covid 19 pandemic on this firm is less pronounced.

Then, we discovered through the context of each crisis that the type of industry could influence the violence of the impact of the crisis, and this especially during the crisis of the Covid-19 pandemic. Some sectors may be much more impacted than others. More specifically, Shen et al. (2020) conducted research on the impact of Covid-19 on certain sectors in particular among listed Chinese companies, i.e., high-risk sectors in the context of the pandemic. These sectors have the characteristics of fostering high social interaction, a strong presence of personnel and export trade. Other studies, in particular the studies of the National Bank of Belgium (2021), have also studied the impact on different sectors and drawn conclusions on the sectors most affected. In order to build a hypothesis based on belonging to certain sectors and test it on the performance during Covid years, we developed a classification of the sectors of our sample on the basis of these same characteristics: social interaction, presence of

staff, import-export (this classification can be found in the appendix). Therefore, we got two distinct groups of companies: companies included into high-risk sectors and companies included into low-risk sectors. In the context of Belgium, our next sub-hypothesis is this one:

H4: When a firm belongs to a low-risk sector of activity, the negative impact of the Covid 19 pandemic on this firm is less pronounced.

Finally, we can end this list of potential hypotheses of factors that can influence the performance of Belgian companies during the Covid-19 pandemic with an elaborate hypothesis on the governmental factor external to the company. As explained in the context of previous crises, the government very often takes exceptional measures in times of economic recession, in order to avoid harmful consequences on society such as unemployment, bankruptcy and cessation of activities. During certain financial crises, the government very often calls on the International Monetary Fund. The International Monetary Fund (IMF) aims to promote sustainable growth and prosperity for all of its member countries, and generally offers external financing in exchange for policies designed to restore the economy. In addition, during the Covid pandemic, the government itself provided financial assistance to companies, as explained in the previous section, with the aim of helping them maintain stable financial health. As explained previously, some authors, mostly Chinese, have studied the impact of subsidies on performance and have obtained positive results. Consequently, it is interesting to wonder about the potentially positive effect of this external financing on the performance of the companies concerned during the pandemic. Our last sub-hypothesis is therefore:

H5: When a firm receives governmental subsidies, the negative impact of the Covid 19 pandemic on this firm is less pronounced.

III. DATA COLLECTION AND METHODOLOGY

1. Sample and data collection

To carry out this master thesis, we collected financial data from Belgian companies using the Bel-First Interface provided by Bureau Van Dijk. This platform offers comprehensive information on companies in Belgium and Luxembourg. In order to carry out this data collection, we carried out several steps to set up criteria:

- First of all, our research relating to Belgian companies, we set a geographical criterion: we excluded all Luxembourg companies.

- Then, we placed a criterion on the legal form of the entities, so as not to select companies such as associations or groups and to keep only pure companies: we only chose SA, SCA, SPRL, SPRLU, SCS, SNC, simple company, and limited liability company.

- Then, we set criteria on the variables we need to model our hypotheses according to a temporality criterion. For this, we first chose all our variables: Return on Assets, Cash and Cash Equivalents, Industry Codes, Total Assets, Liquidity Ratio, Solvency Ratio, Number of Employees, Value Added per Employee, Amount of Subsidies Granted by Public Authorities, Tangible Assets, Intangible Assets and Sales. We then delimited the period that we are studying: to have a broad view, we have chosen to study the years 2017 to 2022, the Covid years being 2020 and 2021. We have therefore excluded all companies for which there are at least a missing variable over the given time period.

- To correctly model our investment efficiency hypothesis, we will explain in the section just below that some of our variables are based on the calculation of the increase from year to year: in particular the variable which captures the growth of sales and the variable that captures the total investment. For this reason, we had to collect company data for an additional year (the year 2016) for the variables Sales, Tangible Assets, Intangible Assets and Total Assets. In addition, it may be noted that the model which approaches investment efficiency is carried out on the basis of sales growth of the previous year, which means that data for the year 2015 should also be collected. However, this additional constraint considerably reduced the sample of companies. Therefore, we decided to keep this number of companies in order to maintain a sufficiently large sample and thus study the hypothesis on investment efficiency over the period 2018-2022, instead of the period 2017-2022.

With all these criteria applied, we obtained a data sample of 2,085 Belgian companies: 12,509 observations in total, and 10,424 observations for the hypothesis on investment efficiency. In order to avoid the presence of outliers, we also directly performed a winsorization at the 5% and 95% level on our continuous variables.

2. Explanation of the models

In order to study the impact of our various factors, we have developed a model for each of our hypotheses, which we will then test by performing a linear regression. In this section, we will define each model as well as each variable that characterizes it.

Our first hypothesis is

H1: The Covid-19 pandemic has a negative impact on the financial performance of Belgian firms.

We modelized it as

$$ROA_{it} = B_0 + B_1*COVID_t + B_2*SIZE_{it} + B_3*NB\_EMPL_{it} + B_4*SOLVENCY_{it} + B_5*LIQUIDITY_{it} + B_6*VA_{it} + B_7*SALES\_GROWTH_{it} + Industry\ Dummies + E_{it}$$

Our sub-hypotheses are

H2: When the financial flexibility of a firm is higher, the negative impact of the Covid 19 pandemic on this firm is less pronounced.

Modelized as

$$ROA_{it} = B_0 + B_1*COVID_t + B_2*FINFLEX_{it} + B_3*COVID\_FINFLEX_{it} + B_4*SIZE_{it} + B_5*NB\_EMPL_{it} + B_6*SOLVENCY_{it} + B_7*LIQUIDITY_{it} + B_8*\ VA_{it} + B_9*SALES\_GROWTH_{it} + Industry\ Dummies + E_{it}$$

H3: When the investment efficiency of a firm is higher, the negative impact of the Covid 19 pandemic on this firm is less pronounced.

Modelized as

$$ROA_{it} = B_0 + B_1*COVID_t + B_2*INVEFF_{it} + B_3*COVID\_INVEFF_{it} + B_4*SIZE_{it} + B_5*NB\_EMPL_{it} + B_6*SOLVENCY_{it} + B_7*LIQUIDITY_{it} + B_8*\ VA_{it} + B_9*SALES\_GROWTH_{it} + Industry\ Dummies + E_{it}$$

H4: When a firm belongs to a low-risk sector of activity, the negative impact of the Covid 19 pandemic on this firm is less pronounced.

Modelized as

$$ROA_{it} = B_0 + B_1*COVID_t + B_2*INDUSTRY_{it} + B_3*COVID\_INDUSTRY_{it} + B_4*SIZE_{it} + B_5*NB\_EMPL_{it} + B_6*SOLVENCY_{it} + B_7*LIQUIDITY_{it} + B_8*\ VA_{it} + B_9*SALES\_GROWTH_{it} + E_{it}$$

H5: When a firm receives governmental subsidies, the negative impact of the Covid 19 pandemic on this firm is less pronounced.

Modelized as

$$ROA_{it} = B_0 + B_1*COVID_t + B_2*SUBSIDIES_{it} + B_3*COVID\_SUBSIDIES_{it} + B_4*SIZE_{it} + B_5*NB\_EMPL_{it} + B_6*SOLVENCY_{it} + B_7*LIQUIDITY_{it} + B_8*\ VA_{it} + B_9*SALES\_GROWTH_{it} + Industry\ Dummies + E_{it}$$

3. Variables

3.1 Dependent variable

ROA_{it} is the dependent variable which refers to the firm performance of firm i in year t, proxied by the Return on Assets ratio (ROA).

3.2 Independent variables

According our five hypotheses, we have defined a set of independent variables: $COVID_t$, $INVEFF_{it}$, $FINFLEX_{it}$, $SUBSIDIES_{it}$ and $INDUSTRY_{it}$ are the independent variables.

The $COVID_t$ variable represents the Covid years. It is a dummy variable that is '0' for years in which there isn't Covid and '1' for the years in which there were covid measures taken by the government. In other words, years 2020 and 2021 take a value of 1 and other years take a value of 0.

$FINFLEX_{it}$ is the variable related to the financial flexibility of companies. Following some of the previous literature studied, financial flexibility is often measured as the level of cash holdings (Lester et al., 2020; Teng et al., 2020). We have chosen to follow this lead because, in view of the numerous studies demonstrating the positive impact of high cash reserves on the performance of companies, this approximation seems justified (Deb et al., 2016; Doan, 2020; Iftikhar, 2017; La Rocca & Cambrea, 2018; Mikkelson & Partch, 2003). We will compare it to the total of assets so that the proxy of financial flexibility is equal to cash and cash equivalents divided by total assets. We add here the distinction between high and low flexibility, by a dummy variable which takes a value of 1 if the company is considered highly financially flexible and 0 if it is not. High financially flexible firms include all observations for which the financial flexibility is greater than the median value, while low financially flexible firms include all observations for which the financial flexibility is lower than the median value.

The $INVEFF_{it}$ variable has a somewhat more complex character: to quantify the investment efficiency, we will use a slightly more sophisticated method. Indeed, in the literature, investment efficiency is often not characterized by a single quantitative approximation, but rather by a function in its own right. According to Benlemlih & Bitar (2015), Biddle et al. (2009), Salehi et al. (2022) and Li et al. (2018), investment efficiency can be materialized according to this model:

$$INV_{it} = B_0 + B_1 x\ LAG\_SALES\_GROWTH_{it-1} + E_{it}$$

These authors explain that this model is constructed as a function of growth opportunities. According to them, sales growth as an approximation of investment opportunities does not come from a particular theory, but more from intuitive reasoning: indeed, an increase in sales implies an increase in demand for products. and, to meet this demand, investing in production facilities is essential. As a result, INV_{it} is the total investment, proxied by the net increase of tangible and intangible assets and scaled by lagged total assets for firm i at year t. $LAG\_SALES\_GROWTH_{it-1}$ is the rate of change in sales from year t − 2 to year t for firm I, and E_{it} is residuals raised from the equation to proxy for investment inefficiency for firm i at year t. The residuals are used as a proxy for investment inefficiency because it shows the deviation of the company's actual investment level from the expected investment. Positive residuals indicate over-investing, and negative residuals indicate under-investing. Therefore, the absolute value of the residuals reflects the overall investment inefficiency of the firms. Since then, a large value of the absolute value of the residuals represents low investment efficiency and a small value of the absolute value of the residuals represents high investment efficiency. In our basic equation which presents our hypothesis linked to investment efficiency, we therefore use these residuals to measure our variable $INVEFF_{it}$. We calculate the median value of the residual distribution, and we

quantify the $INVEFF_{it}$ variable by a dummy variable which takes the value 1 for all companies whose residual value is below the median value (small value therefore indicating high investment efficiency) and which takes 0 for all companies whose residual value is above the median value (large value therefore indicating low investment efficiency).

The $SUBSIDIES_{it}$ variable is measured as the amount of subsidies granted by public authorities. It is quantified by putting a dummy variable equal to 1 if the firm received a support from government and equal to 0 if the firm received no support from government.

The $INDUSTRY_{it}$ variable is quantified thanks to the NACE Bel codes used by the Bel-first database to identify the different sectors. To establish the scope of this variable, we drew our inspiration from the study by Shen et al. (2020). These authors distinguish in one of their hypotheses two main classifications of sectors: sectors with serious impact, recognized as favoring high social interaction, a strong presence of staff or numerous imports and exports, and sectors with non-serious impact, with the opposite characteristics. Based on the same characteristics, we have drawn up a classification of the sectors which can be found in the appendix, using in part our personal interpretation. Regarding the quantification of the variable, it is measured by creating a dummy variable equal to 1 if the company belongs to a low-risk sector (sectors with the opposite characteristics to those presented above) and equal to 0 if the company belongs to a high-risk sector (sectors with the characteristics presented above).

3.3 Control variables

We decided to control for several additional variables, in order to reduce bias in our results. Our control variables are firm-related variables, estimated by a set of firm characteristics that may have an impact on financial performance. We control for the firm size, proxied by the natural logarithm of the total assets, quantified by the $SIZE_{it}$ variable. We also decided to control for the solvency and the liquidity, using an indicator for each concept, because these two concepts are closely related to profitability. The liquidity indicator will be proxied by the Current Assets / Current Liabilities ratio, quantified by the $LIQUIDITY_{it}$ variable, and the solvency indicator will be proxied by the Equity / Total Liabilities ratio, quantified by the $SOLVENCY_{it}$ variable. We also decided to control what concerns the employees of the companies: the natural logarithm of the number of employees, with the NB_EMPL_{it} variable, as well as the added value per employee, with the VA_{it} variable. Finally, we use sales growth as a control variable because, if it is likely to impact investments, it is also likely to influence performance.

3.4 Interaction effects

Our assumptions and models clearly indicate that we are studying the impact of certain factors on business performance during the Covid-19 pandemic. Therefore, we need to add interaction effects between the variables that represent these factors and the variable that models the health crisis, to analyze their combined effect on performance. The interaction effect variable $COVID\_FINFLEX_{it}$ will be a dummy variable that takes 1 for companies that have a level of cash holdings higher than the median value during years 2020 and 2021 and 0 otherwise. $COVID\_INVEFF_{it}$ will be a dummy variable that takes 1 for companies that have a level of investment efficiency lower than the median value during years 2020 and 2021 and 0 otherwise. $COVID\_INDUSTRY_{it}$ will be a dummy variable that takes 1 for companies that are included into low-risk sectors during years 2020 and 2021 and 0 otherwise. $COVID\_SUBSIDIES_{it}$ will be a dummy variable that takes 1 for companies that received government support during years 2020 and 2021 and 0 otherwise.

3.5 Fixed effects

We also added some dummy variables to quantify effects that remain fixed in the linear regression, such as Industry Dummies.

3.6 Other components

The other components are B_0, the constant term, B_1 to B_9, the regression coefficients, and E_{it}, the standard error of the model.

IV. EMPIRICAL RESULTS

After collecting all the data and performing all the calculations, adjustments and restructuring of the data in Excel, a multiple linear regression was performed on each of the models, thanks to the SPSS software, in order to test each of our hypotheses. In this section, we will analyze the results of these regressions, step by step and hypothesis by hypothesis.

1. HYPOTHESIS 1: Impact of the Covid-19 pandemic on performance

As a reminder, the first hypothesis we will test is the hypothesis of the overall negative impact of the Covid-19 pandemic, which is the independent variable here, on the performance of Belgian companies, modeled by the dependent variable ROA.

$$ROA_{it} = B_0 + B_1*COVID_t + B_2*SIZE_{it} + B_3*NB\_EMPL_{it} + B_4*SOLVENCY_{it} + B_5*LIQUIDITY_{it} + B_6* VA_{it} + B_7*SALES\_GROWTH_{it} + Industry\ Dummies + E_{it}$$

1.1 Descriptive statistics, regression results and correlation diagnostics

Table 1.1: Summary of descriptive statistics H1

	N Statistic	Minimum	Maximum	Mean	St. Deviation
ROA	12,509	-0.0733	0.2551	0.0643	0.0828
COVID	12,509	0	1	0.33	0.471
SIZE	12,509	3.6148	5.8244	4.4742	0.6019
NB_EMPL	12,509	0.9542	2.8423	1.8787	0.5083
SOLVENCY	12,509	0.0495	0.8327	0.3982	0.2290
SALES_GROWTH	12,509	-0.2114	0.4412	0.0679	0.1589
LIQUIDITY	12,509	0.4600	4.5700	1.6407	1.0283
VA	12,509	0.0460	0.4280	0.1374	0.0975
Valid N (listwise)	12,509				

Source: Author's work, using SPSS software

If we look more closely at the descriptive statistics of our variables, we can first see that the financial performance ratio is relatively correct on average. When the ROA is below 5%, it is considered low. And when the ratio exceeds 20%, it is considered very good. Here, the companies' average ROA is equal to 6% and therefore remains above the 5% threshold. This means that on average companies generate a 6% return on all their assets and therefore the use of company assets to generate profits is relatively efficient. As for the mean of the COVID variable, it is equal to 0.33, which is logical given that the sample has 6 years and that the years identified as the Covid years are the years 2020 and 2021 and are number of 2.

Regarding solvency and liquidity ratios, we can also see that their averages are quite good. The average current ratio is equivalent to 1.64: a current ratio above 1.5 generally indicates a good level of liquidity, so an average of 1.64 can be considered good. Regarding solvency, if the ratio of equity to total liabilities is less than 20%, the company may be undercapitalized. A good solvency ratio shows a

value between 20% and 45%. Here, the average solvency ratio is equivalent to 39%, which can be considered a good ratio given that it is included in the interval.

However, it is important to mention that good average ratios do not mean that all companies have good ratios: we can also notice this by taking a look at the minimum and maximum values of the distributions. Indeed, the observed minimum of the ROA variable is equal to -0.07, which is very low: it is an indication that the company concerned has recorded a net loss in relation to its total assets, leading to an overall unfavorable financial performance. On the other hand, the maximum observed is equal to 0.25, which is considered an excellent ROA, leading to an overall favorable financial performance. The same observation can be made for the minimums and maximums of the other variables.

Regarding the standard deviations of the variables, we can see that the LIQUIDITY variable has an extremely large standard deviation: the value is equal to 1.02. This means that a lot of individual data points deviate from the mean, even if the data has been winsorized at a 95% level. The other two true SIZE and NB_EMPL also have a fairly high standard deviation, indicating a larger degree of dispersion around the mean. The other variables show a relatively small standard deviation, which indicates a smaller variability.

Table 1.2: Correlation matrix H1

Pearson	ROA	COVID	SIZE	NB_EMPL	SOLVENCY	LIQUIDITY	VA	SALES_GROWTH
ROA	1	0.13	**-0.068**	**-0.028**	**0.252**	**0.224**	**0.372**	**0.191**
COVID	0.13	1	0.13	0.010	**0.021**	**0.023**	0.004	**-0.070**
SIZE	**-0.068**	0.13	1	**0.542**	**0.076**	**-0.087**	**0.417**	**0.054**
NB_EMPL	**-0.028**	0.010	**0.542**	1	**-0.055**	**-0.086**	**-0.219**	-0.005
SOLVENCY	**0.252**	**0.021**	**0.076**	**-0.055**	1	**0.644**	**0.152**	**-0.046**
LIQUIDITY	**0.224**	**0.023**	**-0.087**	**-0.086**	**0.644**	1	**0.054**	**-0.046**
VA	**0.372**	0.004	**0.417**	**-0.219**	**0.152**	**0.054**	1	**0.162**
SALES_GROWTH	**0.191**	**-0.070**	**0.054**	-0.005	**-0.046**	**-0.046**	**0.162**	1

Bold coefficient values indicate statistical significance at the 5% level.

Source: Author's work, using SPSS software

Now we need to look at the correlation between each of our variables. For this, we performed a Pearson correlation matrix as well as a multicollinearity test. Let's first look at the values given by the correlation matrix. All the coefficients which have a value higher than 0.5 indicate that there is a strong correlation between the two variables concerned. The sign of the coefficients is also important, as it indicates the positive or negative nature of the correlation.

We can first observe that there are two coefficients whose values are greater than 0.5: the correlation coefficient between the variables LIQUIDITY and SOLVENCY, equal to 0.677, and the correlation coefficient between the variables SIZE and NB_EMPL, equal to 0.542. This makes sense: the size of a company and its number of employees are bound to be very positively correlated, since a larger company needs a larger number of workers and vice versa. Regarding the liquidity and solvency

ratios, it is also quite intuitive: indeed, these two ratios indicate the ability of a company to meet its financial obligations, on the one hand in the short term and on the other. rated for the long term. Thus, in the short term, insufficient liquidity can also signal low solvency if the company is struggling to repay short-term debts. Conversely, a company must be able to manage its short-term financial obligations to have a more solid basis to meet its long-term obligations. The other coefficients are all reasonable in terms of correlation.

Overall, the relationships between the ROA and the other variables are positive, except for the SIZE and NB_EMPL variables. As the size and number of employees increases, the ROA decreases. The correlation coefficient between the COVID variable and the ROA variable is weakly positive, while the rest of the coefficients show a strong positive relationship with the other variables. This therefore indicates that the more liquidity, solvency, value added per employee and sales growth increase, the more the ROA will also increase. In fact, good management of the company's liquidity, solvency and activities thus promotes better profitability and therefore better global performance.

We can also observe that the correlation coefficients between the COVID variable and the other variables are almost always positive, except with the SALES_GROWTH variable. Again, as before, this result raises a question: indeed, whether intuitively or through the literature, we would tend to expect a negative impact. However, we can notice that the correlation coefficient is always close to 0, which is a low value. Moreover, only the p-values of the correlation between the variable COVID and its variables SOLVENCY, LIQUIDITY and SALES_GROWTH can be considered as statistically significant, being below the threshold of 0.05, compared to the other p-values. The negative relationship between the COVID variable and the SALES_GROWTH variable seems logical, given that the economic crisis resulting from the pandemic has stopped a large part of the activity and therefore necessarily the growth of sales.

We can also observe a negative relationship between the NB_EMPL variable and several other variables like LIQUIDITY, SOLVENCY, ROA, VA, and SALES_GROWTH, which implies that the more the number of employees increases, the more these variables decrease. It may be reasonable in a sense: indeed, an increase in the number of employees could lead to a dilution of productivity, organizational complexity, and redundancy of tasks, leading to a drop in added value per employee. It can also lead to higher labor costs and a longer operating cycle, as well as greater vulnerability to economic volatility, which can affect other variables. However, one must be careful with the p-values which are not always statistically significant. Moreover, the negative correlation coefficients between the SALES_GROWTH variable and several other variables may initially seem surprising. Intuitively, one would think that an increase in sales growth would positively impact liquidity or solvency. But this can be explained by the increase in the need for financing these sales, which can increase the indebtedness or dilute the equity of the company and thus affect its solvency and its liquidity.

Table 1.3: Collinearity diagnostics H1

	Collinearity Statistics VIF
COVID	1.006
SIZE	2.551
NB_EMPL	2.166
SOLVENCY	1.787
LIQUIDITY	1.771
VA	1.906
SALES_GROWTH	1.042

Source: Author's work, using SPSS software

To quantify the multi-collinearity of our regression, we will look at the VIF statistics. The VIF (Variance Inflation Factor) measures the magnitude of multi-collinearity by quantifying how much the variance of an independent variable is increased due to the presence of the linear correlation with other independent variables in the model. A VIF equal to or close to 1 indicates that there is no correlation between the variable of interest and the other independent variables, which means that there is no multi-collinearity. When the VIF exceeds 5, the variables are highly correlated, and multicollinearity is important. Here we can see that all the VIFs are below 5, which proves that the multicollinearity is not significant. Most are close to 1; however, the VIF of the SIZE and NB_EMPL variables are greater than two, indicating that there is moderate multi-collinearity.

Table 1.4: Regression results H1

	Coefficients	Coefficients Std. Error	t	P-value	Sig.
(Constant)	0.161	0.029	5.572	< 0.001	***
COVID	0.003	0.001	2.355	0.019	**
SIZE	-0.072	0.002	-42.714	< 0.001	***
NB_EMPL	0.065	0.002	34.193	< 0.001	***
SOLVENCY	0.092	0.004	24.406	< 0.001	***
VA	0.465	0.009	53.297	< 0.001	***
LIQUIDITY	0.000	0.001	0.140	0.888	
SALES_GROWTH	0.082	0.004	20.636	< 0.001	***
Industry Dummies	Yes				
Valid N (listwise)	12,509				
R-square	0.294				
Adj. R-square	0.292				
Model Std. Error	0.06967				
Df	30				
F-Change	173.237***				

*Statistical significance is recognized by *** (1% level), ** (5% level), and * (10% level).*

Source: Author's work, using SPSS software

First, let's take a closer look at the coefficients of the variables in our regression. The first coefficient B0, called the constant coefficient, shows that the average level of return on assets is equal to 0.161 when all variables are equal to 0. If we then focus on the independent variable COVID whose purpose is to study the Indeed, we can see that the coefficient has a value of 0.03. This means that for every one unit increase in the COVID variable, the dependent variable ROA will increase by an average of 0.03 units. This therefore implies a positive impact of the Covid-19 pandemic on company performance, which does not seem very consistent with our basic hypothesis.

Regarding our other variables, we can see that they all also have a positive influence on the ROA, except the SIZE variable which shows a negative coefficient. The results show that for every one unit increase in the SIZE variable, the ROA will decrease by an average of 0.72 units. This indicates that if the size of the company (modeled here by its total assets) increases, the ROA will decrease. We can also note that the LIQUIDITY variable, modeled by the current ratio, is the variable that shows the least

impact compared to the other variables. On the other hand, the variable that indicates the highest impact is the variable VA, with a coefficient equal to 0.465.

Regarding the significance of the coefficients, we can first observe that the p-values of all the variables are significant, except that of the LIQUIDITY variable: the p-values of the control variables are below the threshold of 0.001 and the p-value of the variable COVID is below the threshold of 0.05, which means that the relationships studied through the coefficients are strong and significant. However, the p-value of the LIQUIDITY variable is equal to 0.888, indicating that the coefficient of this variable is not statistically significant. Moreover, the standard errors of the coefficients' column show values always close to 0, which is an indicator of coefficient precision since the standard error of a coefficient is measured as the standard deviation of the error made in the estimating. The smaller the standard error, the more precise the estimation of the coefficient.

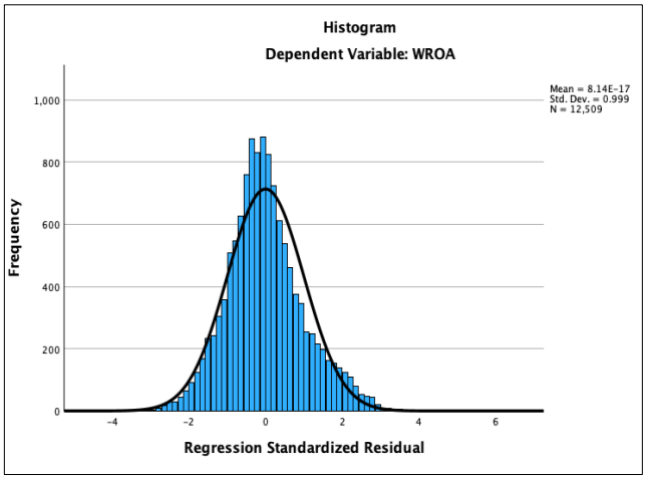
Regarding now the validity of the model, we can interpret the different measures below the coefficients. The R-squared (R^2) of a regression, also known as the coefficient of determination, is a statistical measure that represents the proportion of the variance in the dependent variable that is explained by the independent variables in the regression model. In other words, R-squared tells us how well the independent variables in the regression model can account for the variation in the dependent variable. It provides an indication of the goodness-of-fit of the model to the observed data. The value of R-squared ranges from 0 to 1, where 0 means that the independent variables in the model do not explain any of the variation in the dependent variable, and 1 means that the independent variables perfectly explain all the variation in the dependent variable. The R-squared value here is equal to 0.292. This value is closer to 0 than 1, which means that only approximately 30% of the variation in the dependent variable is explained by the independent variables in the regression model. In other words, the predictors in the model can account for 30% of the variability in the observed data. It indicates that the regression model provides a modest fit to the data, but there might be room for improvement to better capture the relationship between the predictors and the dependent variable.

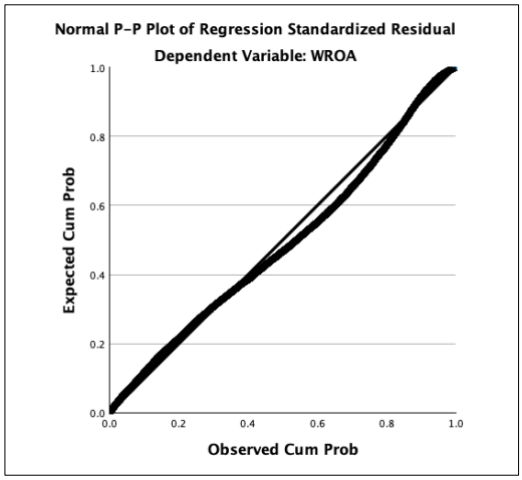
In addition, we can interest ourselves in the concept of degrees of freedom. This notion refers to the number of independent pieces of information that are available to estimate the parameters (coefficients) of the regression model. The concept of degrees of freedom is important in statistical inference because it affects the accuracy and precision of the estimated regression coefficients and the statistical significance of the model. The higher the number of degrees of freedom, the more accurate the estimates will be. In this case, we have a degree of freedom which is equivalent to 30, which is quite high, and therefore allows a better confidence in the results of the model.

Moreover, we can also look at the standard error of the regression model. It is a measure of the accuracy of the estimated coefficients in the regression equation: smaller standard errors imply that the estimated coefficients are likely to be closer to the true population values, while larger standard errors suggest more variability or uncertainty in the estimates. The standard error of our regression model is equal to 0.0696, which is a very small value. It indicates that the estimations of the coefficients are precise.

Finally, the F-test is used in a regression model to determine the overall significance of the regression equation and test whether the independent variables as a group have a significant effect on the dependent variable. A larger F-value suggests that the independent variables significantly improve the model, while a smaller F-value indicates that the model may not be a good fit for the data. In our case, the F-test value is equal to 173.23 and its p-value is below the critical threshold of 0.001, which confirms that the model is statistically significant.

Figure 1.1 and Figure 1.2: Residuals H1





Source: Author's work, using SPSS software

If we now look at the behavior of the residuals, we can clearly observe that their distribution follows a normal law, with a rather leptokurtic character. Moreover, we can notice that the P-P plot (probability-probability plot) shows that the data fits the model well, which reinforces the reliability of the model.

Global remark: In view of the results obtained, we notice that there are correlations present between the variables SOLVENCY and LIQUIDITY, and NB_EMPL and SIZE. To avoid model biases, we decided to remove the LIQUIDITY and NB_EMPL control variables in the following hypotheses, in order to avoid having the same problems.

2. HYPOTHESIS 2: Impact of financial flexibility on performance during the pandemic

The second hypothesis to be tested is the hypothesis concerning the impact of financial flexibility on performance in times of crisis. Firms with higher financial flexibility would experience less of a drop in performance during the Covid-19 pandemic than firms with lower financial flexibility.

$$ROA_{it} = B_0 + B_1*COVID_t + B_2*FINFLEX_{it} + B_3*COVID\_FINFLEX_{it} + B_4*SIZE_{it} + B_5*SOLVENCY_{it} + B_6*VA_{it} + B_7*SALES\_GROWTH_{it} + Industry\ Dummies + E_{it}$$

2.1 Descriptive statistics, regression results and correlation diagnostics

Table 2.1: Summary of descriptive statistics H2

	N Statistic	Minimum	Maximum	Mean	St. Deviation
ROA	12,509	-0.0733	0.2551	0.0643	0.0828
COVID	12,509	0	1	0.33	0.471
FINFLEX	12,509	0	1	0.50	0.500
COVID_FINFLEX	12,509	0	1	0.17	0.380
SIZE	12,509	3.6148	5.8244	4.4742	0.6019
SOLVENCY	12,509	0.0495	0.8327	0.3982	0.2290
SALES_GROWTH	12,509	-0.2114	0.4412	0.0679	0.1589
VA	12,509	0.0460	0.4280	0.1374	0.0975
Valid N (listwise)	12,509				

Source: Author's work, using SPSS software

The descriptive statistics of the variables used in the first hypothesis have already been studied in the previous section. Therefore, we will not return to it. Regarding the FINFLEX and COVID_FINFLEX variables, we can study their mean and standard deviation. We can observe that the mean and the standard deviation of the FINFLEX variable are equal to 0.5. A mean equal to 0.5 means that, on average, the dummy variable shows a high financial flexibility in 50% of the observations and a low financial flexibility in the other 50% of the observations. It suggests that the two categories represented by the dummy variable are equally distributed in the dataset. This result is logical, as the dataset is split into two subgroups from the median value of the distribution.

In addition, for a binary variable like a dummy, the standard deviation will generally be high, close to 0.5 for an evenly distributed dataset or close to 0 if most of the observations are concentrated in one category. The standard deviation of 0.5 indicates that the variable's values are evenly dispersed around the mean.

Regarding the COVID_FINFLEX variable, the mean of 0.17 and the standard deviation of 0.380 suggest that companies with higher financial flexibility during Covid years occur less frequently compared companies with lower financial flexibility during Covid years. The data points deviate from the mean to some extent, suggesting that there might be some variability in the occurrence of the event.

Table 2.2: Correlation matrix H2

Pearson	ROA	COVID	FINFLEX	COVID_FINFLEX	SIZE	SOLVENCY	VA	SALES_GROWTH
ROA	1	0.13	**0.167**	**0.072**	**-0.068**	**0.252**	**0.293**	**0.191**
COVID	0.13	1	**0.034**	**0.651**	0.13	**0.021**	0.006	**-0.070**
FINFLEX	**0.167**	**0.034**	1	**0.460**	**-0.178**	**0.115**	**-0.036**	-0.002
COVID_FINFLEX	**0.072**	**0.651**	**0.460**	1	**-0.073**	**0.056**	**-0.018**	**-0.050**
SIZE	**-0.068**	0.13	**-0.178**	**-0.073**	1	**0.076**	**0.405**	**0.054**
SOLVENCY	**0.252**	**0.021**	**0.115**	**0.056**	**0.076**	1	**0.105**	**-0.046**
VA	**0.293**	0.006	**-0.036**	**-0.018**	**0.405**	**0.105**	1	**0.143**
SALES_GROWTH	**0.191**	**-0.070**	-0.002	**-0.050**	**0.054**	**-0.046**	**0.143**	1

Bold coefficient values indicate statistical significance at the 5% level.

Source: Author's work, using SPSS software

With regard to the Pearson matrix, we can directly see that there are no longer very high correlation coefficients between the control variables as noted during the test of the previous hypothesis. Indeed, as the LIQUIDITY and NB_EMPL variables have been removed, this effect is no longer present. The only coefficient indicating a very high correlation greater than 0.5 is the coefficient between the variables COVID and COVID_FINFLEX, equal to 0.651. However, this correlation makes total sense, given that the dummy variable COVID_FINFLEX reports the interaction effect between the variable COVID and the variable FINFLEX. When the variable COVID_FINFLEX shows the value 1, the variable COVID also always shows the value 1 since the studied effect relates to the Covid years. This strong correlation is therefore normal. The same observation is to be applied between the variable FINFLEX and the variable COVID_FINFLEX.

Next, we can notice that the FINFLEX variable is positively correlated with the ROA, COVID and SOLVENCY variables, while it is negatively correlated with the SIZE, VA, and SALES_GROWTH variables. As explained above, the positive correlation of financial flexibility with ROA and solvency is reasonable: indeed, many studies prove the positive impact of financial flexibility with performance and, having as an approximation the cash reserves, it is normal to see that solvency increases when liquidity increases in view of their interconnections. As for negative correlations, this may make sense for size. Many authors show that the larger a company, the less easy it is for it to accumulate a lot of cash reserves and to be financially flexible. In addition, strong financial flexibility can lead to excessive retention of cash, rather than investing it in profitable projects or expansion opportunities, which can cause a risk of missing opportunities for sales growth and improving added value per employee.

The COVID_FINFLEX variable addresses positive and negative correlation coefficients with the same variables as the FINFLEX variable. It can therefore be seen that the pandemic crisis does not cause any notable change in the nature of the correlation between the FINFLEX variable and the other variables. The p-values associated with these correlation coefficients generally confirm that they can be considered statistically significant at the 0.1% or 5% level, except for that between the variable SALES_GROWTH and FINFLEX which exceeds these thresholds.

Table 2.3: Collinearity diagnostics H2

	Collinearity Statistics VIF
COVID	2.059
FINFLEX	1.583
COVID_FINFLEX	2.604
SIZE	1.336
SOLVENCY	1.073
VA	1.336
SALES_GROWTH	1.034

Source: Author's work, using SPSS software

To quantify the multi-collinearity of our regression, we can look at the VIF statistics. We can see that all the VIFs of the control variables are close to 1, which is an improvement compared to the previous hypothesis. However, the VIF of the COVID and COVID_FINFLEX variables are greater than two, indicating that there is moderate multi-collinearity. Once again, given the very present interconnections between the two variables, this result is not surprising and seems normal. Every interaction effect studied with the variable COVID will most certainly show the same result.

Table 2.4: Regression results H2

	Coefficients	Coefficients Std. Error	t	P-value	Sig.
(Constant)	0.103	0.030	3.432	< 0.001	***
COVID	0.005	0.002	2.362	0.018	**
FINFLEX	0.020	0.002	12.538	< 0.001	***
COVID_FINFLEX	-0.004	0.003	-1.300	0.194	
SIZE	-0.028	0.001	-22.686	< 0.001	***
SOLVENCY	0.078	0.003	26.578	< 0.001	***
VA	0.303	0.008	39.628	< 0.001	***
SALES_GROWTH	0.086	0.004	20.698	< 0.001	***
Industry Dummies	Yes				
Valid N (listwise)	12,509				
R-square	0.240				
Adj. R-square	0.239				
Model Std. Error	0.07227				
Df	30				
F-Change	131.653***				

*Statistical significance is recognized by *** (1% level), ** (5% level), and * (10% level).*

Source: Author's work, using SPSS software

If we now focus on the regression coefficients, we can first observe that the variable FINFLEX has a coefficient of 0.02. It indicates that for each one-unit increase in the FINFLEX variable, the dependent variable which is the ROA is expected to increase by 0.02 units, holding all other variables constant. The coefficient is positive: it suggests a positive relationship, meaning that an increase in the

variable FINFLEX leads to an increase in the variable ROA. This result is completely in line with the literature. Indeed, many studies have shown that greater financial flexibility has a positive impact on business performance.

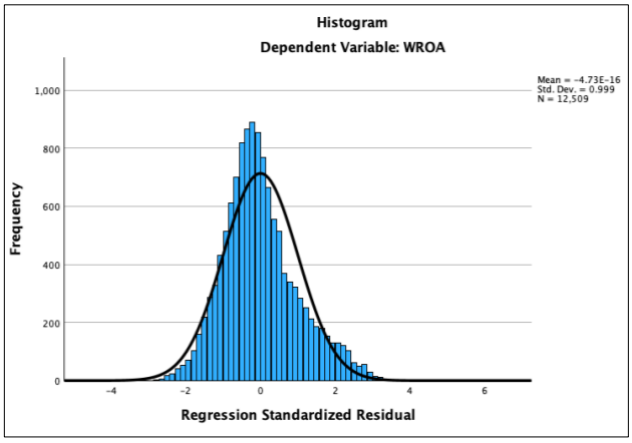
On the other hand, if we then look at the coefficient of the variable COVID_FINFLEX, which represents the interaction between high financial flexibility and the Covid-19 pandemic, we can observe that it is negative, with a rather low value. This indicates a negative relationship between this interaction and ROA, implying that corporate performance will decline even if financial flexibility is higher during the Covid-19 pandemic. This result seems rather inconsistent given the positive relationship between the COVID variable and the ROA variable. However, when an interaction effect exists between two independent variables in a regression model, it indicates that the influence of one variable depends on the level or value of the other variable. As a result, this can lead to unanticipated effects on the dependent variable, even when these independent variables individually show a positive impact on the dependent variable and especially given the fact that, by observing the mean of the distribution of the variable COVID_FINFLEX, companies with high financial flexibility and companies with low financial flexibility are relatively equally distributed.

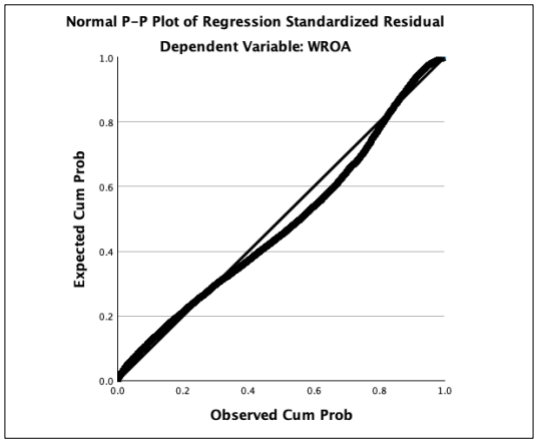
Nevertheless, we can notice that the p-value associated with the variable COVID_FINFLEX is equal to 0.194, which is a value higher than the thresholds of 5%, 1% and 0.1%. We can therefore say that this result is not statistically significant. On the other hand, the p-value associated with the variable FINFLEX is less than 0.001, which indicates that this result is statistically significant at the 0.1% level.

Regarding the other variables, we can see that the results are quite similar to the results of hypothesis 1. The COVID variable still addresses a positive impact on the ROA variable with a statistically significant result at the 5% level. The other variables show statistically significant results at the 0.1% level. The ROA variable decreases further when the SIZE variable increases, implying a negative relationship between the size of the company and its performance, and again, the more solvency, sales growth and value added per employee increase, the more performance increases.

Regarding now the validity of the model, the R-squared value is 0.239, which indicates that approximately 25% of the variation in the dependent variable can be accounted for by the independent variables in the regression model. Since the R-squared value is closer to 0 than 1, it suggests that the predictors in the model provide only a modest fit to the data. In other words, about 25% of the observed data's variability can be explained by the relationship between the predictors and the dependent variable. This finding implies that there is room for improvement in the model to better capture the relationship between the predictors and the dependent variable. In addition, we can see that we have 30 degrees of freedom, which is a relatively large value. This ample degree of freedom instills greater confidence in the reliability of the model's results. The standard error of our regression model is recorded at 0.0722, a notably small value. This suggests that the estimations of the coefficients are highly precise, instilling confidence in the reliability of the model's results. Last, the F-test confirms that the model is statistically significant, with a large statistically significant value of 131.65, indicating that the group of independent variables has a substantial impact on the dependent variable.

Figure 2.1 and Figure 2.2: Residuals H2





Source: Author's work, using SPSS software

Upon examining the residuals, it is evident that their distribution closely adheres to a normal pattern, exhibiting a slight leptokurtic nature. Furthermore, the P-P plot provides strong evidence that the data fits the model exceptionally well. These findings reinforce the model's reliability and underscore its appropriateness for the given dataset.

2.2 Additional analysis: Propensity Score Matching

Thanks to the table of descriptive statistics, we could observe that the average of the variable COVID_FINFLEX was equal to 0.17, which indicated that there were many more companies present in the sample with lower financial flexibility during Covid (around 85%) than higher financial flexibility (around 15%). As a result, this unequal distribution could lead to certain biases in our study: we want to be certain that the non-statistically significant result is not due to an imbalance of the sample at this level. This is why we are going to add in this section a part containing an additional analysis favoring a balance in the sample between the companies presenting a high financial flexibility and a low financial flexibility during the Covid years.

To achieve this, we will use the technique of propensity score matching. Propensity score matching is a statistical technique used in observational studies to reduce the potential bias that arises when comparing treatment and control groups. This matching technique is widely studied and used in the statistical literature, especially in a case like this where the observed mean reflects a possible bias in the balance of the sample (Caliendo & Kopeinig, 2008). The propensity score is the probability of receiving the treatment given a set of observed covariates (variables that might influence the treatment assignment). In our case, the covariates are the control variables of our model. The propensity score matching procedure is as follows:

- Estimate Propensity Scores: we calculate the propensity scores for each subject in the study using a binary logistic regression model. The model estimates the probability of being assigned to the treatment group based on the observed covariates. The treatment group consists of individuals who have received the treatment under investigation (here, the treatment group is the group with higher financial flexibility), while the control group consists of individuals who have not received the treatment (group with lower financial flexibility).

- Propensity Score Matching: Once the propensity scores are estimated using logistic regression, they are used to match treated and untreated subjects. Propensity scores matching aims to create pairs or groups of individuals with similar propensity scores, where one individual from the treatment group is matched to one individual from the control group with the nearest neighbor matching. The threshold used to determine how closely the propensity scores of individuals in the treatment group can match with those in the control group (caliper width) corresponds to 10% of the standard deviation.

- New regression model with the matching sample: once the propensity score matching has been performed, we obtain a new sample equitably established between companies with high and low financial flexibility during Covid. We can therefore test this new sample with our multiple linear regression.

Table 2.5: Propensity score matching H2

COVID_FINFLEX	Number	Paired	Percentage	Unpaired	Percentage
1	2,186	2,184	100%	2	0%
0	10,323	2,184	21%	8,139	79%
Valid N (listwise)	12,509				

Source: Author's work, using SPSS software

Logistic regression and propensity score matching calculations were performed using the XLSTAT interface. As the table indicates, 2,184 companies with high financial flexibility were able to be associated with 2,184 companies with low financial flexibility.

Table 2.6: New descriptive statistics H2

	N Statistic	Minimum	Maximum	Mean	St. Deviation
ROA	4,368	-0.0733	0.2551	0.0727	0.0863
COVID	4,368	0	1	0.59	0.490
FINFLEX	4,368	0	1	0.71	0.452
COVID_FINFLEX	4,368	0	1	0.50	0.500
SIZE	4,368	3.6148	5.8244	4.3860	0.5686
SOLVENCY	4,368	0.0495	0.8327	0.4297	0.2316
SALES_GROWTH	4,368	-0.2114	0.4412	0.0500	0.1608
VA	4,368	0.0460	0.4280	0.1343	0.0947
Valid N (listwise)	4,368				

Source: Author's work, using SPSS software

Table 2.7: New regression results H2

	Coefficients	Coefficients Std. Error	t	P-value	Sig.
(Constant)	0.091	0.038	2.378	0.017	**
COVID	0.008	0.004	1.793	0.073	*
FINFLEX	0.022	0.004	6.030	< 0.001	***
COVID_FINFLEX	-0.009	0.005	-1.757	0.079	*
SIZE	-0.032	0.002	-14.197	< 0.001	***
SOLVENCY	0.072	0.005	14.465	< 0.001	***
VA	0.342	0.013	25.466	< 0.001	***
SALES_GROWTH	0.116	0.007	16.308	< 0.001	***
Industry Dummies	Yes				
Valid N (listwise)	4,368				
R-square	0.271				
Adj. R-square	0.266				
Model Std. Error	0.07395				
Df	30				
F-Change	53.755***				

*Statistical significance is recognized by *** (1% level), ** (5% level), and * (10% level).*

Source: Author's work, using SPSS software

We can see from the descriptive statistics table that the mean and the standard deviation of the variable COVID_FINFLEX are now equal to 0.5, indicating a balance between companies with high and low financial flexibility during the Covid years. On the other hand, we can notice that the means

of the variables COVID and FINFLEX have also increased. This is obvious: by balancing the distribution of the variable COVID_FINFLEX, we reduce the observations likely to take the value 0 for the variables COVID and FINFLEX.

If we now focus on the table showing the results of the linear regression run on the new balanced sample, we can see that the regression coefficient of the variable COVID_FINFLEX is still negative, implying a negative influence of higher financial flexibility on performance during the pandemic. This result therefore corroborates the result of the previous regression. This would indicate that a one unit increase in financial flexibility would decrease ROA by 0.009 units. Moreover, in this new regression, we can see that the coefficient is statistically significant at the 10% level, which was not the case for the first regression. We can therefore more rely on this result and draw the same conclusions as for the basic regression. Regarding the other coefficients, the results are similar to those of the first regression.

3. HYPOTHESIS 3: Impact of investment efficiency on performance during the pandemic

The third hypothesis to be tested is the hypothesis concerning the impact of investment efficiency on performance in times of crisis. Firms characterized by a higher level of investment efficiency would experience a lower drop in performance during the Covid-19 pandemic than firms characterized by a lower level of investment efficiency.

As explained in the section Methodology, we approximate the investment efficiency by using a more sophisticated method. Indeed, in the literature, investment efficiency is often defined by a function in its own right. According to Benlemlih & Bitar (2015), Salehi et al. (2022), Li et al. (2018), investment efficiency can be materialized according to this model:

$$INV_{it} = B_0 + B_1 x\ LAG\_SALES\_GROWTH_{it-1} + E_{it}$$

The residuals of this equation are used as a firm-specific proxy for investment inefficiency because it shows the deviation of the company's actual investment level from the expected investment. Positive residuals or positive deviation from expected investment indicates over-investing, and negative residuals indicate under-investing. Therefore, the absolute value of the residuals reflects the overall investment inefficiency of the firms. Since then, a large value of the absolute value of the residuals represents low investment efficiency and a small value of the absolute value of the residuals represents high investment efficiency. From this, a dummy variable INVEFF is created from the residuals, taking the value of 1 for firms with high investment efficiency (lower than the median value of the residuals) and 0 for firms with low investment efficiency (higher than the median value of the residuals).

$$ROA_{it} = B_0 + B_1*COVID_t + B_2*INVEFF_{it} + B_3*COVID\_INVEFF_{it} + B_4*SIZE_{it} + B_5*SOLVENCY_{it} + B_6*VA_{it} + B_7*SALES\_GROWTH_{it} + Industry\ Dummies + E_{it}$$

3.1 Descriptive statistics, regression results and correlation diagnostics

Table 3.1: Summary of descriptive statistics H3

	N Statistic	Minimum	Maximum	Mean	St. Deviation
ROA	10,424	-0.0733	0.2551	0.0648	0.0837
COVID	10,424	0	1	0.40	0.490
INVEFF	10,424	0	1	0.50	0.500
COVID_INVEFF	10,424	0	1	0.20	0.402
SIZE	10,424	3.6148	5.8244	4.4742	0.6019
SOLVENCY	10,424	0.0495	0.8327	0.3999	0.2290
SALES_GROWTH	10,424	-0.2114	0.4412	0.0664	0.1612
VA	10,424	0.0460	0.4280	0.1385	0.0979
Valid N (listwise)	10,424				

Source: Author's work, using SPSS software

The descriptive statistics for the variables relevant to the first hypothesis were previously examined in the preceding section. Therefore, we will not review those findings. However, we will

discuss the mean and the standard deviation of the variables INVEFF and COVID_INVEFF. We notice that both the mean and the standard deviation of the INVEFF variable are 0.5. A mean of 0.5 implies that, on average, the dummy variable indicates high investment efficiency in 50% of the observations and low investment efficiency in the other 50% of the observations. This outcome is expected, as the dataset is divided into two subgroups based on the median value of the distribution, so the distribution is equally distributed into the two categories. As a result, the standard deviation of 0.5 indicates that the variable's values are evenly dispersed around the mean. Concerning the COVID_INVEFF variable, its mean is calculated as 0.20. This suggests that approximately 20% of the firms of the sample are characterized with a higher investment efficiency during the Covid years, while 80% of the firms are characterized with a lower investment efficiency during the Covid years. In addition, the standard deviation of 0.402 reveals some dispersion of observations around the mean, indicating variability in the distribution of the dummy variable.

Table 3.2: Correlation matrix H3

Pearson	ROA	COVID	INVEFF	COVID_INVEFF	SIZE	SOLVENCY	VA	SALES_GROWTH
ROA	1	0.09	**0.055**	**0.029**	**-0.060**	**0.255**	**0.303**	**0.203**
COVID	0.09	1	0.010	**0.617**	0.004	**0.018**	-0.002	**-0.072**
INVEFF	**0.055**	0.010	1	**0.504**	**0.186**	**0.072**	**0.055**	**-0.021**
COVID_ INVEFF	**0.029**	**0.617**	**0.504**	1	**0.101**	**0.046**	**0.029**	**-0.054**
SIZE	**-0.060**	0.004	**0.186**	**0.101**	1	**0.072**	**0.405**	**0.063**
SOLVENCY	**0.255**	**0.018**	**0.072**	**0.046**	**0.072**	1	**0.113**	**-0.039**
VA	**0.303**	-0.002	**0.055**	**0.029**	**0.405**	**0.113**	1	**0.148**
SALES_GROWTH	**0.203**	**-0.072**	**-0.021**	**-0.054**	**0.063**	**-0.039**	**0.148**	1

Bold coefficient values indicate statistical significance at the 5% level.

Source: Author's work, using SPSS software

Looking at the Pearson correlation matrix, we once again observe that the only coefficients showing a strong correlation are the ones between the COVID_INVEFF variable and both COVID and INVEFF variables. As we deduced in hypotheses 2, 3, and 4, this correlation is expected and reasonable, given that the COVID_INVEFF dummy variable represents the interaction effect between the COVID and INVEFF variables.

Further, we can see that the INVEFF and the COVID_INVEFF variables are positively correlated with all other variables expected SALES_GROWTH, with a statistical significance at the 1% level. They are negatively correlated with the variable SALES_GROWTH with a statistical significance at the 5% level. It implies that companies characterized by a higher investment efficiency are more likely to experiment an increase in performance, solvency and added value per employee, whether this efficiency is associated with the impact of the pandemic or not. In addition, larger firms seem to be more likely to have high investment efficiency. However, the correlation with the SALES_GROWTH variable is negative, which seems to be abnormal at the start. But this could be explained because improving investment efficiency is often associated with a focus on maximizing profitability and return on investment. While this can lead to improved financial performance, it may not necessarily align with a growth-oriented strategy.

We can also notice that the INVEFF and the COVID variable are positively correlated. However, the p-value associated with this correlation coefficient is equal to 0.159, which indicates that this result is not statistically significant.

Table 3.3: Collinearity diagnostics H3

	Collinearity Statistics VIF
COVID	2.015
INVEFF	1.759
COVID_INVEFF	2.695
SIZE	1.347
SOLVENCY	1.058
VA	1.341
SALES_GROWTH	1.035

Source: Author's work, using SPSS software

To quantify the multi-collinearity of our regression, we can examine the VIF statistics. We can see that all the VIFs of the control variables are close to 1, which shows few multi-collinearities. However, the VIF of the COVID and COVID_INVEFF variables are greater than two, indicating that there is moderate multi-collinearity. Once again, given the very present interconnections between the two variables, this result is not surprising and seems normal.

Table 3.4: Regression results H3

	Coefficients	Coefficients Std. Error	t	P-value	Sig.
(Constant)	0.131	0.033	3.955	< 0.001	***
COVID	0.004	0.002	2.116	0.034	**
INVEFF	0.012	0.002	6.475	< 0.001	***
COVID_INVEFF	-0.002	0.003	-0.770	0.441	
SIZE	-0.033	0.001	-23.553	< 0.001	***
SOLVENCY	0.082	0.003	25.458	< 0.001	***
VA	0.313	0.008	36.950	< 0.001	***
SALES_GROWTH	0.092	0.005	20.403	< 0.001	***
Industry Dummies	Yes				
Valid N (listwise)	10,424				
R-square	0.240				
Adj. R-square	0.238				
Model Std. Error	0.07313				
Df	30				
F-Change	109.501***				

*Statistical significance is recognized by *** (1% level), ** (5% level), and * (10% level).*

Source: Author's work, using SPSS software

If we now focus on the regression coefficients, we can first observe that the variable INVEFF has a coefficient of 0.012. It indicates that for each one-unit increase in the INVEFF variable, the dependent variable which is the ROA is expected to increase by 0.012 units, holding all other variables constant. We can also observe that the coefficient is positive which suggests a positive relationship, meaning that an increase in the variable INVEFF leads to an increase in the variable ROA. This result is completely in line with the literature: we indeed previously found many studies which have demonstrated that higher investment efficiency has a positive impact on financial performance.

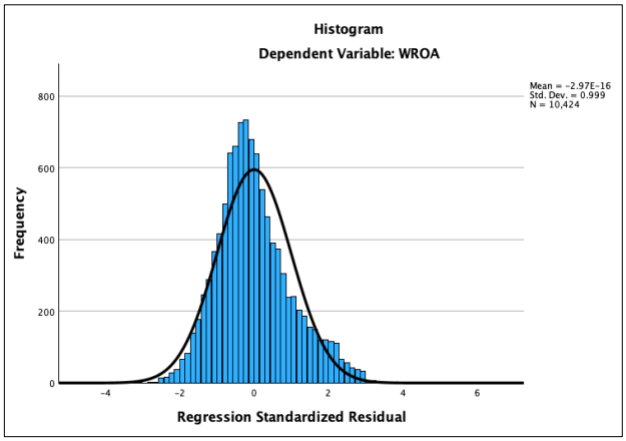
On the other hand, if we then look at the coefficient of the variable COVID_INVEFF, which represents the interaction between higher investment efficiency and the Covid-19 pandemic, we can observe that it is negative. This indicates a negative relationship between this interaction and the ROA, implying that corporate performance will decline even if investment efficiency is higher during the Covid-19 pandemic. This result seems rather inconsistent given the positive relationship between the COVID variable and the ROA variable. However, as explained for the previous hypotheses, interaction effets may lead to unanticipated effects on the dependent variable, even when these independent variables individually show a positive impact on the dependent variable.

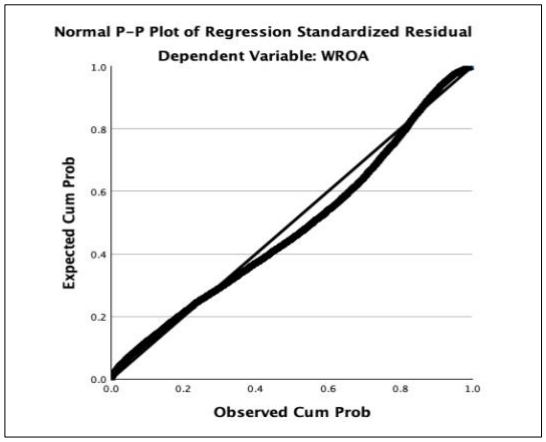
We can also notice that the p-value associated with the variable COVID_INVEFF is equal to 0.441, which allows us to conclude that we need to caution with this non-statistically significant result as the p-value is higher than the thresholds of 5%. On the other hand, the p-value associated with the variable INVEFF is less than 0.001, which indicates that this result is statistically significant at the 0.1% level and thus that it is reliable.

Regarding the other variables, we can see that the results are quite similar to the results of hypothesis 1. The COVID variable still addresses a positive impact on the ROA variable with a statistically significant result at the 5% level. The other variables show statistically significant results at the 0.1% level. The ROA variable decreases further when the SIZE variable increases, implying a negative relationship between the size of the company and its performance, and again, the more solvency, sales growth and value added per employee increase, the more performance increases.

Regarding the validity of the model, the R-squared value is 0.240, indicating that approximately 25% of the variability in the dependent variable can be attributed to the relationship with the independent variables in the model. As the R-squared value is closer to 0 than 1, it suggests that the model's predictors provide a moderate fit to the data. Simply put, around 25% of the observed data's variability can be accounted for by the predictors' influence on the dependent variable. This finding implies that the model could be enhanced to better capture this relationship and achieve greater statistical significance. We can also observe that there are 30 degrees of freedom, which is a relatively high value. This ample degree of freedom enhances the reliability of the model. In this instance, we can also see that the standard error of the regression model is 0.0731, reflecting a notably small value. This suggests that the coefficient estimates are highly precise, instilling confidence in the reliability of the model's results. Finally, the F-test value is 109.50, and its corresponding p-value is below the critical threshold of 0.001. This result confirms that the model is statistically significant, signifying that the group of independent variables has a considerable impact on the dependent variable.

Figure 3.1 and Figure 3.2: Residuals H3





Source: Author's work, using SPSS software

We can observe on the residuals chart that their distribution closely approaches a normal pattern. Moreover, the P-P plot provides strong evidence that the data fits the model exceptionally well. These results validate the reliability of the model and emphasize its appropriateness for the given dataset.

3.2 Additional analysis: Propensity Score Matching

Utilizing the descriptive statistics table, we were able to observe that the mean value of the variable COVID_INVEFF stood at 0.20. This finding suggests a significant disparity in the sample, with proportion of approximately 80% of companies exhibiting lower investment efficiency during the Covid period, compared to a proportion of around 20% of companies with higher investment efficiency. Consequently, this skewed distribution raises concerns about potential biases influencing our study's outcomes, and we want to ensure that the lack of statistical significance is not attributed to an imbalance within the sample at this level.

To address this concern, we will proceed to conduct an additional analysis involving propensity score matching, employing the same methodology as employed for hypothesis 2. This approach will allow us to refine our examination and enhance the validity and reliability of our conclusions.

Table 3.5: Propensity score matching H3

COVID_INVEFF	Number	Paired	Percentage	Unpaired	Percentage
1	2,110	2,104	100%	6	0%
0	8,314	2,104	25%	6,210	75%
Valid N (listwise)	10,424				

Source: Author's work, using SPSS software

Logistic regression and propensity score matching calculations were performed using the XLSTAT interface. As the table indicates, 2,104 companies with high investment efficiency were able to be matched with 2,104 companies with low investment efficiency.

Table 3.6: New descriptive statistics H3

	N Statistic	Minimum	Maximum	Mean	St. Deviation
ROA	4,208	-0.0733	0.2551	0.0659	0.0832
COVID	4,208	0	1	0.62	0.485
INVEFF	4,208	0	1	0.69	0.459
COVID_INVEFF	4,208	0	1	0.50	0.500
SIZE	4,208	3.6148	5.8244	4.5949	0.6324
SOLVENCY	4,208	0.0495	0.8327	0.4218	0.2323
SALES_GROWTH	4,208	-0.2114	0.4412	0.0486	0.1599
VA	4,208	0.0460	0.4280	0.1450	0.1008
Valid N (listwise)	4,208				

Source: Author's work, using SPSS software

The descriptive statistics table reveals a noteworthy shift in the variable COVID_INVEFF, with both the mean and standard deviation now at 0.5. This shift signifies a newfound equilibrium between companies with high and low investment efficiency throughout the Covid years. Concurrently, we observe an upward trend in the means of the variables COVID and INVEFF. This development is intuitive: the effort to achieve a balanced distribution of the COVID_INVEFF variable results in a reduction of the observations that take a value of 0 for the variables COVID and INVEFF.

Table 3.7: New regression results H3

	Coefficients	Coefficients Std. Error	t	P-value	Sig.
(Constant)	0.147	0.037	3.938	< 0.001	***
COVID	0.005	0.004	1.085	0.278	
INVEFF	0.016	0.004	4.378	< 0.001	***
COVID_INVEFF	-0.004	0.005	-0.854	0.393	
SIZE	-0.032	0.002	-15.319	< 0.001	***
SOLVENCY	0.066	0.005	13.412	< 0.001	***
VA	0.290	0.013	22.444	< 0.001	***
SALES_GROWTH	0.111	0.007	15.490	< 0.001	***
Industry Dummies	Yes				
Valid N (listwise)	4,208				
R-square	0.239				
Adj. R-square	0.234				
Model Std. Error	0.07284				
Df	30				
F-Change	43.740***				

*Statistical significance is recognized by *** (1% level), ** (5% level), and * (10% level).*

Source: Author's work, using SPSS software

If we now focus on the table showing the results of the linear regression run on the new balanced sample, we can see that the regression coefficient of the variable COVID_INVEFF is still negative, implying a negative influence of higher investment efficiency on performance during the pandemic. It is also still non statistically significant, as its p-value is equal to 0.393. This result is therefore similar to the result of the previous regression.

In addition, the results of this new regression now indicate statistical non-significance of the COVID variable, which was not the case previously. This indicates that, for this hypothesis, reducing and balancing the sample does not lead to more statistical reliability, neither for the variable COVID_INVEFF, nor for the variable COVID. As far as the other variables are concerned, the results agree with those of the first regression.

4. HYPOTHESIS 4: Impact of low-risk sectors on performance during the pandemic

The fourth hypothesis to be tested is the hypothesis concerning the impact of less risky sectors on performance in times of crisis. Firms from sectors characterized by a lower level of risk would experience less of a drop in performance during the Covid-19 pandemic than firms from sectors characterized by a higher level of risk.

$$ROA_{it} = B_0 + B_1*COVID_t + B_2*INDUSTRY_{it} + B_3*COVID\_INDUSTRY_{it} + B_4*SIZE_{it} + B_5*SOLVENCY_{it} + B_6*VA_{it} + B_7*SALES\_GROWTH_{it} + E_{it}$$

4.1 Descriptive statistics, regression results and correlation diagnostics

Table 4.1: Summary of descriptive statistics H4

	N Statistic	Minimum	Maximum	Mean	St. Deviation
ROA	12,509	-0.0733	0.2551	0.0643	0.0828
COVID	12,509	0	1	0.33	0.471
INDUSTRY	12,509	0	1	0.32	0.468
COVID_INDUSTRY	12,509	0	1	0.1081	0.310
SIZE	12,509	3.6148	5.8244	4.4742	0.6019
SOLVENCY	12,509	0.0495	0.8327	0.3982	0.2290
SALES_GROWTH	12,509	-0.2114	0.4412	0.0679	0.1589
VA	12,509	0.0460	0.4280	0.1374	0.0975
Valid N (listwise)	12,509				

Source: Author's work, using SPSS software

The descriptive statistics for the variables relevant to the first hypothesis were previously examined in the preceding section. Therefore, we will not revisit those findings. However, let's now focus on the variables INDUSTRY and COVID_INDUSTRY, and explore their mean and standard deviation. The mean of the INDUSTRY variable is found to be 0.32. This indicates that, on average, approximately 32% of the firms in the sample possess a value of 1. It implies that around 32% of the firms belong to low-risk sectors, while approximately 68% belong to high-risk sectors. The relatively high standard deviation of 0.468, close to 0.5, suggests that the observations are not widely spread around the mean, and the distribution of the dummy variable is moderately balanced between its two categories.

As for the COVID_SUBSIDIES variable, its mean is calculated as 0.10. This suggests that approximately 90% of the observations in the sample have a value of 0 for this dummy variable, indicating that the majority of firms in low-risk sectors did not receive subsidies during the Covid years. Additionally, the standard deviation of 0.35 reveals some dispersion of observations around the mean, indicating variability in the distribution of the dummy variable.

Table 4.2: Correlation matrix H4

Pearson	ROA	COVID	INDUSTRY	COVID_ INDUSTRY	SIZE	SOLVENCY	VA	SALES_GROWTH
ROA	1	0.13	**-0.016**	-0.008	**-0.068**	**0.252**	**0.293**	**0.191**
COVID	0.13	1	0.000	**0.492**	0.13	**0.021**	0.006	**-0.070**
INDUSTRY	**-0.016**	0.000	1	**0.502**	**0.029**	**-0.067**	**0.086**	**0.018**
COVID_ INDUSTRY	-0.008	**0.492**	**0.502**	1	**0.025**	**-0.021**	**0.049**	**-0.035**
SIZE	**-0.068**	0.13	**0.029**	**0.025**	1	**0.076**	**0.405**	**0.054**
SOLVENCY	**0.252**	**0.021**	**-0.067**	**-0.021**	**0.076**	1	**0.105**	**-0.046**
VA	**0.293**	0.006	**0.086**	**0.049**	**0.405**	**0.105**	1	**0.143**
SALES_GROWTH	**0.191**	**-0.070**	**0.018**	**-0.035**	**0.054**	**-0.046**	**0.143**	1

Bold coefficient values indicate statistical significance at the 5% level.

Source: Author's work, using SPSS software

Regarding the Pearson matrix, we can once again notice that the only coefficients indicating a high correlation are the coefficient between the COVID_INDUSTRY variable and the COVID and the INDUSTRY variables. The statement to be deducted from this observation is the same than in the hypothesis 2 and 3: this correlation is reasonable, given that the dummy variable COVID_INDUSTRY reports the interaction effect between the variable COVID and the variable INDUSTRY. We can also see that the INDUSTRY and the COVID variables show null correlation. However, the p-value associated with this correlation coefficient is equal to 0.498, which indicates that this result is not statistically significant.

Next, we can notice that the INDUSTRY variable is negatively correlated with the ROA and SOLVENCY, with a statistical significance at the 5% level. It implies that companies that belong to low-risk sectors are more likely to see their performance and their solvency decrease. On the other hand, the correlation with the other variables is statistically significant and positive, which means that the low-risk sector influences positively the added value per employee and the growth of sales. Regarding the size, the correlation is also positive, which indicates that firms that are included into low-risk sectors tend to have a bigger size.

Regarding the correlation coefficients of the COVID_INDUSTRY variable, we can notice a statistically significant negative relation with the SOLVENCY and SALES_GROWTH variables. This means that the solvency and the growth of sales of low-risk firms tend to decrease during the Covid years. We can observe the same correlation with the ROA variable, but we have to caution on it because the p-value of 0.175 shows a non-statistically significant result. In addition, the correlation coefficients between the COVID_INDUSTRY variable and the SIZE and VA variables are positive with statistical significance: companies that belong to less risky sectors are more likely to see their added value per employee increase.

Table 4.3: Collinearity diagnostics H4

	Collinearity Statistics VIF
COVID	1.484
INDUSTRY	1.513
COVID_INDUSTRY	1.981
SIZE	1.198
SOLVENCY	1.023
VA	1.237
SALES_GROWTH	1.030

Source: Author's work, using SPSS software

To examine the multi-collinearity of our regression, we can look at the VIF statistics. We can see that all the VIFs of the control variables are close to 1, which indicates that there are few multi-collinearities. However, like for the previous interaction effects captured in the previous hypotheses, the VIF of the COVID_INDUSTRY variable is the highest, as it shows the interaction effect between the variable COVID and the variable INDUSTRY.

Table 4.4: Regression results H4

	Coefficients	Coefficients Std. Error	t	P-value	Sig.
(Constant)	0.127	0.005	24.478	< 0.001	***
COVID	0.004	0.002	2.623	0.009	***
INDUSTRY	-0.004	0.002	-2.108	0.035	**
COVID_INDUSTRY	-0.003	0.003	-0.945	0.345	
SIZE	-0.032	0.001	-26.705	< 0.001	***
SOLVENCY	0.087	0.003	29.744	< 0.001	***
VA	0.289	0.008	38.469	< 0.001	***
SALES_GROWTH	0.087	0.004	20.720	< 0.001	***
Industry Dummies	No				
Valid N (listwise)	12,509				
R-square	0.209				
Adj. R-square	0.208				
Model Std. Error	0.07369				
Df	7				
F-Change	470.721***				

*Statistical significance is recognized by *** (1% level), ** (5% level), and * (10% level).*

Source: Author's work, using SPSS software

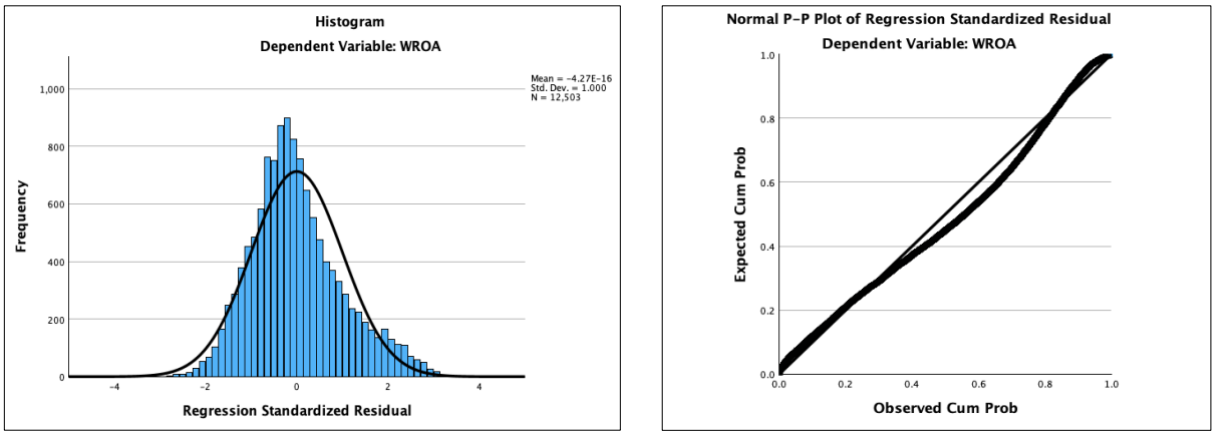
Let us now focus on the regression coefficients. We can first observe that the coefficient of the INDUSTRY variable is equal to -0.004, associated with a p-value equal to 0.035. It indicates that the INDUSTRY variable has a statistically significant negative impact on our dependent variable, which is the ROA, at a 5% level. This means that for each one-unit increase in INDUSTRY, the ROA is expected to decrease by 0.004 units: this suggests that the low-risk sectors industry is more likely to see its

performance decrease. If we examine the coefficient for the variable COVID_INDUSTRY, representing the interaction effect between firms belonging to low-risk sectors and the Covid-19 pandemic, we also observe a negative value. This indicates a negative relationship between this interaction and the ROA, implying that corporate performance may decline even with during the Covid-19 pandemic even if firms are included into low-risk sectors. As explained in the previous hypotheses, an interaction effect between independent variables can lead to unexpected outcomes on the dependent variable. But, in this case, given the fact that firms included into low-risk sectors may experience a decrease in performance in general, we can imagine that the impact on performance may still be negative during the pandemic. However, the limited number of observations of low-risk companies during the Covid years, as indicated by the mean of the COVID_INDUSTRY distribution, might also influence these results. Moreover, the p-value associated with this variable is equal to 0.345, which indicates that we have to be careful with this result as it cannot be considered as statistically significant.

Regarding the other variables, we observe similar outcomes to those hypothesized initially. The COVID variable still exhibits a positive impact on ROA with statistical significance at the 5% level, while the other variables show statistically significant results at the 0.1% level. The ROA decreases with increasing SIZE, implying a negative relationship between company size and performance. Additionally, higher solvency, sales growth, and value added per employee lead to increased performance.

Regarding the validity of the model, the R-squared value is 0.208, indicating that approximately 20% of the variability in the dependent variable can be accounted for by the independent variables in the model. Since the R-squared value is closer to 0 than 1, it suggests that the model's predictors offer a moderate fit to the data. In simpler terms, about 20% of the observed data's variability can be attributed to the relationship between the predictors and the dependent variable. This finding suggests that the model could be improved to better capture this relationship and to be more statistically significant. In this particular case, we can notice 7 degrees of freedom, which is not really a relatively large number and is lower than for the other hypotheses. However, it is logical, as the dummy variable related to the sectors are captured into the dummy variable concerning the risk characterization of the sectors. Concerning the standard error of the regression model, its value of 0.0736 is quite small. Once again, the F-test value is 470.721, which is high, and its corresponding p-value is below the critical threshold of 0.001. This result confirms statistical significance.

Figure 4.1 and Figure 4.2: Residuals H4



Source: Author's work, using SPSS software

By examining the residuals, we can notice that their distribution closely approaches a normal pattern. Moreover, the P-P plot provides strong evidence that the data fits the model exceptionally well. These findings serve to validate the model's reliability and underscore its suitability for the specific dataset.

4.2 Additional analysis: Propensity Score Matching

Analyzing the descriptive statistics table, we observed that the mean value for the variable COVID_INDUSTRY was recorded at 0.10. This observation unveils a notable imbalance within the sample, where approximately 90% of companies belong to high-risk sectors during the Covid period, in contrast to the mere 10% of companies affiliated with low-risk sectors. The resulting skewed distribution prompts concerns about potential biases impacting the outcomes of our study. It is imperative to ensure that any absence of statistical significance is not erroneously attributed to an uneven sample distribution at this level.

In response to this concern, we will follow the same methodology employed for hypotheses 2 and 3 and conduct an additional analysis through propensity score matching to enhance the precision of our investigation.

Table 4.5: Propensity score matching H4

COVID_INDUSTRY	Number	Paired	Percentage	Unpaired	Percentage
1	1,352	1,346	100%	6	0%
0	11,151	1,346	12%	9,805	88%
Valid N (listwise)	12,509				

Source: Author's work, using SPSS software

Logistic regression and propensity score matching calculations were performed using the XLSTAT interface. As the table indicates, 1,346 companies that belong to low-risk sectors were able to be matched with 1,346 companies that belong to high-risk sectors.

Table 4.6: New descriptive statistics H4

	N Statistic	Minimum	Maximum	Mean	St. Deviation
ROA	2,692	-0.0733	0.2551	0.0629	0.0845
COVID	2,692	0	1	0.62	0.484
INDUSTRY	2,692	0	1	0.63	0.482
COVID_INDUSTRY	2,692	0	1	0.50	0.500
SIZE	2,692	3.6148	5.8244	4.5191	0.6330
SOLVENCY	2,692	0.0495	0.8327	0.3790	0.2308
SALES_GROWTH	2,692	-0.2114	0.4412	0.0573	0.1639
VA	2,692	0.0460	0.4280	0.1507	0.1105
Valid N (listwise)	2,692				

Source: Author's work, using SPSS software

The table of descriptive statistics highlights a significant transformation within the COVID_INDUSTRY variable, evidenced by its mean and standard deviation both reaching a value of 0.5. This indicates that the sample is now balanced between high and low-risk industries during Covid years. Simultaneously, we detect an upward trend in the average values of the COVID and INDUSTRY variables. As explained previously, this is logical, as we increase the number of observations that takes the value of 1 for the COVID and INDUSTRY variables.

Table 4.7: New regression results H4

	Coefficients	Coefficients Std. Error	t	P-value	Sig.
(Constant)	0.147	0.012	12.477	< 0.001	***
COVID	0.003	0.005	0.552	0.581	
INDUSTRY	-0.005	0.005	-0.889	0.374	
COVID_INDUSTRY	0.000	0.007	0.024	0.981	
SIZE	-0.032	0.003	-12.122	< 0.001	***
SOLVENCY	0.066	0.007	10.051	< 0.001	***
VA	0.217	0.015	14.055	< 0.001	***
SALES_GROWTH	0.089	0.009	9.618	< 0.001	***
Industry Dummies	No				
Valid N (listwise)	2,692				
R-square	0.148				
Adj. R-square	0.145				
Model Std. Error	0.07813				
Df	7				
F-Change	66.454***				

*Statistical significance is recognized by *** (1% level), ** (5% level), and * (10% level).*

Source: Author's work, using SPSS software

If we now focus on the table showing the results of the linear regression run on the new balanced sample, we can see that the regression coefficient of the variable COVID_INDUSTRY is null. This indicates that the fact that a company belongs to a sector considered low risk has no influence on ROA, and therefore no impact on its financial performance. This result differs from the result of the previous regression, which showed a negative coefficient. However, it is also still non statistically significant, as its p-value is equal to 0.981, which means that we cannot draw reliable conclusions from a statistical point of view.

In addition, the results of this new regression now indicate statistical non-significance of the COVID and INDUSTRY coefficients, even if the nature of their sign is the same. This was not the case previously. This indicates that, for this hypothesis, reducing and balancing the sample does not lead to more statistical reliability, neither for the variable COVID_INDUSTRY, nor for the variable COVID and nor for the variable INDUSTRY. In fact, the results of this regression allow us to draw fewer statistically significant conclusions than the results of the first regression. Regarding the other variables, the results agree with those of the first regression.

5. HYPOTHESIS 5: Impact of public subsidies on performance during the pandemic

The last hypothesis to be tested is the hypothesis concerning the impact of government support on performance in times of crisis. Firms with government subsidies would experience less of a drop in performance during the Covid-19 pandemic than firms with no government subsidies.

$$ROA_{it} = B_0 + B_1*COVID_t + B_2*SUBSIDIES_{it} + B_3*COVID\_SUBSIDIES_{it} + B_4*SIZE_{it} + B_5*SOLVENCY_{it} + B_6*VA_{it} + B_7*SALES\_GROWTH_{it} + Industry\ Dummies + E_{it}$$

5.1 Descriptive statistics, regression results and correlation diagnostics

Table 5.1: Summary of descriptive statistics H5

	N Statistic	Minimum	Maximum	Mean	St. Deviation
ROA	12,509	-0.0733	0.2551	0.0643	0.0828
COVID	12,509	0	1	0.33	0.471
SUBSIDIES	12,509	0	1	0.41	0.493
COVID_SUBSIDIES	12,509	0	1	0.1457	0.352
SIZE	12,509	3.6148	5.8244	4.4742	0.6019
SOLVENCY	12,509	0.0495	0.8327	0.3982	0.2290
SALES_GROWTH	12,509	-0.2114	0.4412	0.0679	0.1589
VA	12,509	0.0460	0.4280	0.1374	0.0975
Valid N (listwise)	12,509				

Source: Author's work, using SPSS software

The descriptive statistics of the variables used in the first hypothesis have already been studied in the previous section. Therefore, we will not return to it. Regarding the SUBSIDIES and COVID_SUBSIDIES variables, we can study their mean and standard deviation. We can see that the mean of the SUBSIDIES variable is equal to 0.41. It means that, on average, approximately 41% of the firms in the sample show a value of 1: it indicates that approximately 41% of the firms in the sample received government support. The standard deviation of 0.493 is relatively high, close to 0.5, which indicates that the observations are not highly dispersed around the mean and that the distribution of the dummy variable is relatively balanced between its two categories.

Regarding the COVID_SUBSIDIES variable, the mean of 0.14 suggests that around 86% of the observations have a value of 0 for this dummy variable, which means that most of firms have not received government subsidies during the Covid years. In addition, the standard deviation of 0.35 suggests that the observations are somewhat dispersed around the mean, indicating some variability in the distribution of the dummy variable.

Table 5.2: Correlation matrix H5

Pearson	ROA	COVID	SUBSIDIES	COVID_SUBSIDIES	SIZE	SOLVENCY	VA	SALES_GROWTH
ROA	1	0.13	-0.013	-0.005	**-0.068**	**0.252**	**0.293**	**0.191**
COVID	0.13	1	**0.032**	**0.584**	0.13	**0.021**	0.006	**-0.070**
SUBSIDIES	**-0.013**	**0.032**	1	**0.491**	**-0.035**	0.014	**-0.127**	0.005
COVID_SUBSIDIES	-0.005	**0.584**	**0.491**	1	**-0.016**	**0.018**	**-0.063**	**-0.042**
SIZE	**-0.068**	0.13	**-0.035**	**-0.016**	1	**0.076**	**0.405**	**0.054**
SOLVENCY	**0.252**	**0.021**	0.014	**0.018**	**0.076**	1	**0.105**	**-0.046**
VA	**0.293**	0.006	**-0.127**	**-0.063**	**0.405**	**0.105**	1	**0.143**
SALES_GROWTH	**0.191**	**-0.070**	0.005	**-0.042**	**0.054**	**-0.046**	**0.143**	1

Bold coefficient values indicate statistical significance at the 5% level.

Source: Author's work, using SPSS software

Regarding the Pearson matrix, we can once again notice that the only coefficient indicating a very high correlation greater than 0.5 is the coefficient between the variables COVID and COVID_SUBSIDIES, equal to 0.584. The statement to be deducted from this observation is the same than in the hypothesis 2: this correlation makes total sense, given that the dummy variable COVID_SUBSIDIES reports the interaction effect between the variable COVID and the variable SUBSIDIES. When the variable COVID_SUBSIDIES shows the value 1, the variable COVID also always shows the value 1 since the studied effect relates to the Covid years. This strong correlation is therefore normal. The same statement is to be applied between the variable SUBSIDIES and the variable COVID_SUBSIDIES.

Next, we can notice that the SUBSIDIES variable is positively correlated with the COVID, SOLVENCY and SALES_GROWTH variables, while it is negatively correlated with the ROA, SIZE and VA variables. On the other hand, the COVID_SUBSIDIES variable is also positively correlated with the SOLVENCY variable, but negatively correlated with the ROA, SIZE, VA, and SALES_GROWTH variables. The positive relationship between the COVID variable and the SUBSIDIES variable implies that the pandemic influences the number of subsidies given. Moreover, this correlation is statistically significant, as its p-value is below the threshold of 0.05. On the other hand, the results show a non-statistically significant negative correlation between the ROA variable and the SUBSIDIES and COVID_SUBSIDIES variables, which is difficult to interpret.

We can also notice that the SUBSIDIES and COVID_SUBSIDIES variables have a statistically significant positive relationship with the SOLVENCY variable, implying that the presence of subsidies and the presence of subsidies during the Covid years are likely to improve solvency. On the other hand, these subsidies are likely to lower the value added per employee in view of the reliable negative relationship between these variables and the VA variable. Similarly, the SIZE variable is negatively correlated with the subsidy variables, in a statistically significant way, indicating that the larger the size of the company, the less likely it is to receive subsidies.

Table 5.3: Collinearity diagnostics H5

	Collinearity Statistics VIF
COVID	1.750
SUBSIDIES	1.589
COVID_SUBSIDIES	2.297
SIZE	1.299
SOLVENCY	1.052
VA	1.350
SALES_GROWTH	1.035

Source: Author's work, using SPSS software

To evaluate the multi-collinearity of our regression, we can look at the VIF statistics. We can see that all the VIFs of the control variables are close to 1, which indicates that there is few multi-collinearities. However, the VIF of the COVID_SUBSIDIES variable is greater than two, as it captures the interaction effect between the variable COVID and the variable SUBSIDIES and is therefore more likely to show more multi-collinearity given the interconnections.

Table 5.4: Regression results H5

	Coefficients	Coefficients Std. Error	t	P-value	Sig.
(Constant)	0.117	0.030	3.865	< 0.001	***
COVID	0.004	0.002	2.420	0.016	**
SUBSIDIES	0.003	0.002	1.846	0.065	*
COVID_SUBSIDIES	-0.002	0.003	-0.829	0.407	
SIZE	-0.031	0.001	-25.203	< 0.001	***
SOLVENCY	0.083	0.003	28.579	< 0.001	***
VA	0.308	0.008	39.636	< 0.001	***
SALES_GROWTH	0.086	0.004	20.634	< 0.001	***
Industry Dummies	Yes				
Valid N (listwise)	12,509				
R-square	0.228				
Adj. R-square	0.226				
Model Std. Error	0.07285				
Df	30				
F-Change	122.909***				

*Statistical significance is recognized by *** (1% level), ** (5% level), and * (10% level).*

Source: Author's work, using SPSS software

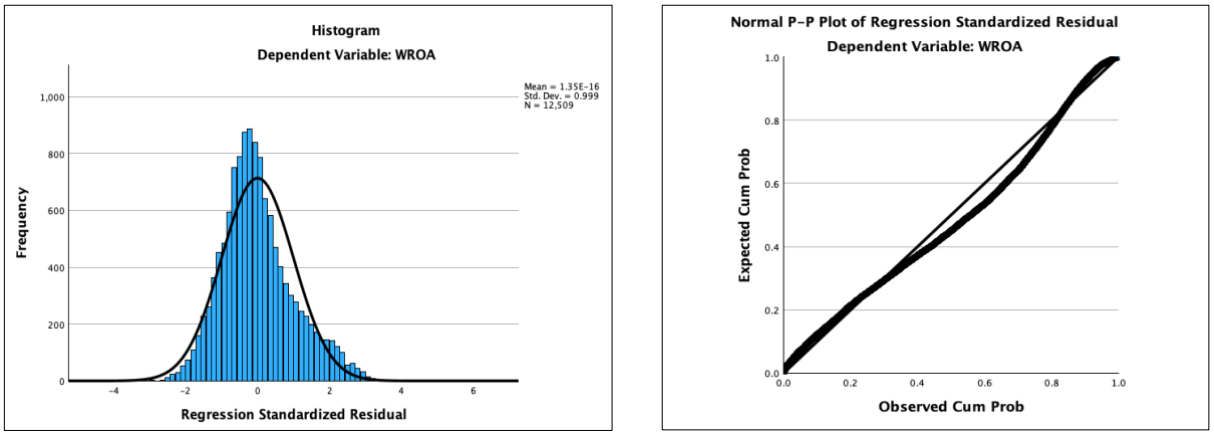
Let us now focus on the regression coefficients. Firstly, the coefficient for the variable SUBSIDIES is 0.03. This indicates that, holding all other variables constant, for each one-unit increase in SUBSIDIES, the ROA is expected to increase by 0.03 units. The positive sign of the coefficient suggests that an increase in SUBSIDIES leads to an increase in ROA, which aligns with findings from prior research where government support in China has shown to positively impact business performance.

On the other hand, if we examine the coefficient for the variable COVID_SUBSIDIES, representing the interaction effect between government subsidies and the Covid-19 pandemic, we observe a negative value, albeit relatively small. This indicates a negative relationship between this interaction and ROA, implying that corporate performance may decline even with government support during the Covid-19 pandemic. This result may seem inconsistent given the positive relationships seen with the individual SUBSIDIES and ROA variables. However, it's essential to consider that an interaction effect between independent variables can lead to unexpected outcomes on the dependent variable, even when these independent variables individually have a positive impact on it. Moreover, the limited number of companies that received subsidies during the Covid years, as indicated by the mean of the COVID_SUBSIDIES distribution, might also influence these results. Notably, the p-values associated with the SUBSIDIES and COVID_SUBSIDIES variables are 0.06 and 0.4, respectively, exceeding the typical significance thresholds of 5%, 1%, and 0.1%. Therefore, these results may not be statistically significant.

Regarding the other variables, we observe similar outcomes to those hypothesized initially. The COVID variable still exhibits a positive impact on ROA with statistical significance at the 5% level, while the other variables show statistically significant results at the 0.1% level. The ROA decreases with increasing SIZE, implying a negative relationship between company size and performance. Additionally, higher solvency, sales growth, and value added per employee lead to increased performance.

Regarding the validity of the model, the R-squared value is 0.226, suggesting that approximately 25% of the variation in the dependent variable can be attributed to the independent variables in the regression model. Since the R-squared value is closer to 0 than 1, it indicates that the predictors in the model offer only a modest fit to the data. In simpler terms, around 25% of the observed data's variability can be explained by the relationship between the predictors and the dependent variable. This finding implies that there is room for improvement in the model to better capture the relationship between the predictors and the dependent variable. We also have 30 degrees of freedom, which instills greater confidence in the reliability of the model. The standard error of our regression model is recorded at 0.0728, a notably small value. This suggests that the estimations of the coefficients are highly precise, instilling confidence in the reliability of the model's results. Last, the F-test value is 122.90, and its corresponding p-value is below the critical threshold of 0.001. This result confirms that the model is statistically significant, indicating that the group of independent variables has a substantial impact on the dependent variable.

Figure 5.1 and Figure 5.2: Residuals H5



Source: Author's work, using SPSS software

After analyzing the residuals, it becomes apparent that their distribution closely resembles a normal pattern, displaying a mild leptokurtic characteristic. Additionally, the P-P plot provides compelling evidence that the data fits the model exceptionally well. These discoveries further validate the model's reliability and emphasize its appropriateness for the specific dataset.

5.2 Additional analysis: Propensity Score Matching

Regarding the descriptive statistics table, it came to our attention that the mean value of the COVID_SUBSIDIES variable was registered at 0.14. This insight reveals an imbalance within the sample, where approximately 85% of companies operated without government support during the Covid period, in contrast to the mere 15% of companies that did receive such assistance. This skewed distribution raises legitimate apprehensions regarding potential biases that could affect the outcomes of our study, essentially at the balance of the sample level.

To address this concern comprehensively, we will adhere to the same procedure as applied in hypotheses 2, 3, and 4. We will once again conduct an additional analysis through propensity score matching to contribute to the credibility and reliability of our conclusions.

Table 5.5: Propensity score matching H5

COVID_SUBSIDIES	Number	Paired	Percentage	Unpaired	Percentage
1	1,823	1,821	100%	2	0%
0	10,686	1,821	17%	8,865	83%
Valid N (listwise)	12,509				

Source: Author's work, using SPSS software

Logistic regression and propensity score matching calculations were performed using the XLSTAT interface. As the table indicates, 1,821 companies that received government subsidies were able to be associated with 1,821 companies that did not receive government subsidies.

Table 5.6: New descriptive statistics H5

	N Statistic	Minimum	Maximum	Mean	St. Deviation
ROA	3,642	-0.0733	0.2551	0.0607	0.0831
COVID	3,642	0	1	0.61	0.488
SUBSIDIES	3,642	0	1	0.66	0.472
COVID_SUBSIDIES	3,642	0	1	0.50	0.500
SIZE	3,642	3.6148	5.8244	4.4574	0.5925
SOLVENCY	3,642	0.0495	0.8327	0.4110	0.2275
SALES_GROWTH	3,642	-0.2114	0.4412	0.0526	0.1639
VA	3,642	0.0460	0.4280	0.1229	0.0850
Valid N (listwise)	3,642				

Source: Author's work, using SPSS software

We can see from the descriptive statistics table that the mean and the standard deviation of the variable COVID_SUBSIDIES are now equal to 0.5, indicating a balance between companies with and without government support during the Covid years. On the other hand, we can notice that the means of the variables COVID and SUBSIDIES have also increased, which is once again obvious, as we reduce the observations likely to take the value 0 for the variables COVID and SUBSIDIES.

Table 5.7: New regression results H5

	Coefficients	Coefficients Std. Error	t	P-value	Sig.
(Constant)	0.134	0.052	2.599	0.009	***
COVID	0.004	0.004	0.932	0.352	
SUBSIDIES	0.005	0.004	1.344	0.179	
COVID_SUBSIDIES	-0.001	0.006	-0.258	0.797	
SIZE	-0.029	0.002	-12.621	< 0.001	***
SOLVENCY	0.083	0.005	15.269	< 0.001	***
VA	0.342	0.016	20.871	< 0.001	***
SALES_GROWTH	0.117	0.007	15.727	< 0.001	***
Industry Dummies	Yes				
Valid N (listwise)	3,642				
R-square	0.256				
Adj. R-square	0.250				
Model Std. Error	0.07196				
Df	30				
F-Change	41.487***				

*Statistical significance is recognized by *** (1% level), ** (5% level), and * (10% level).*

Source: Author's work, using SPSS software

If we now focus on the table showing the results of the linear regression run on the new balanced sample, we can see that the regression coefficient of the variable COVID_INDUSTRY is still negative. This indicates that a company which receives government subsidies has a negative influence on ROA, and therefore a negative impact on its financial performance. This result corroborates the result of the previous regression, as it is also still non statistically significant. At this level, we still cannot draw reliable conclusions from a statistical point of view.

In addition, the results of this new regression now indicate statistical non-significance of the COVID and SUBSIDIES coefficients, even if the nature of their sign is the same, which was not the case previously. This indicates that, for this hypothesis, reducing and balancing the sample reduces the statistical reliability of the coefficients of the COVID and INDUSTRY variables COVID. In fact, the results of this regression allow us to draw fewer statistically significant conclusions than the results of the first regression. Regarding the other variables, the results agree with those of the first regression.

V. DISCUSSION

The results obtained from the different regressions conducted enable us to initiate specific discussions about the different hypotheses constructed around several factors. Indeed, we first globally tested the impact of the Covid-19 pandemic on Belgian firms' performance. Afterwards, we tested the impact of several other factors that may attenuate the negative effect of the pandemic on performance or even increase it, as financial flexibility, investment efficiency, governmental subsidies, and non-risky sectors.

We will first start by discussing the results of the first hypothesis, i.e., the hypothesis concerning the global impact of the health crisis on corporate performance. The findings do not support Hypothesis 1, as it states that the impact of the pandemic on performance is negative. The results of the multiple linear regression reveal that the Covid-19 crisis has a positive influence on the financial performance of companies, as the relationship between our ROA performance variable and our COVID variable is statistically significantly positive. This result seems abnormal at first sight and inconsistent with the literature. Indeed, many recent scientific studies study the influence of the pandemic and have found that its impact deteriorates business performance in different countries (Bennis & Oudda, 2021; Hu & Zhang, 2021; Shen et al., 2020; Zheng, 2022; Chu et al., 2021). In addition, some organizations such as the National Bank of Belgium (2021) report performance drops of a large number of Belgian companies following the Covid-19 outbreak. However, other investigations confirm this result. Darabee (2022) demonstrated in his Palestinian study that he observes no significant difference in the ROA of companies before and during the pandemic. Khatib & Nour (2021) provided empirical evidence that the Covid-19 crisis does not significantly impact business performance, as there is also no significant change before and after the pandemic period. Once again, organizations such as the National Bank of Belgium (2021) also list that while three-quarters of companies experienced a decline in their performance during the health crisis, a quarter of them nevertheless recorded good performance results.

Subsequently, several other factors were added to the regressions according to each hypothesis, to study their effect as well as their effect of interaction with the Covid-19 pandemic on company performance. We have studied two factors internal to companies, of a more financial nature, and two factors external to companies, of a governmental and sectoral nature. Hypothesis 2 captures the influence of the first financial factor: the financial flexibility during the pandemic. Thanks to higher financial flexibility, companies could observe a lesser drop in performance or even benefit from an increase. The results performed by the analysis of the linear regression do not confirm our hypothesis. Indeed, the interaction effect characterized by high financial flexibility during the years 2020 and 2021 shows a non-statistically significant negative relationship with ROA. This implies that we cannot infer from any empirical evidence that high financial flexibility influences financial performance during the health crisis period. On the other hand, we were able to determine a positive influence of high financial flexibility on ROA, which confirms that the higher the financial flexibility (characterized by high cash reserves), the more the company's performance increases. This finding is totally in line with the literature studied through the literature review of this master thesis. As a reminder, numerous well-regarded scientific articles explain the positive impact of high financial flexibility or high cash reserves on company performance: notably Teng et al. (2021), Mikkelson & Partch (2003), La Rocca & Cambrea (2018), Doan (2020), Deb et al. (2016) and Ma & Jin (2016). Additional analyzes including propensity scores matching confirmed the first results by showing a negative relationship, this time statistically significant, regarding the interaction between high financial flexibility and the pandemic. As a result, these statistical results lead to a rejection of our hypothesis and contradict the empirical evidence of some authors who have studied that financial flexibility was a very important and impacting characteristic to fight against economic shocks (Fahlenbrach et al., 2020; Iftikhar, 2017; Lester et al., 2020).

Afterwards, we ran the multiple linear regression on Hypothesis 3, dealing with the second firm-internal financial factor. This hypothesis states that when a company's investment efficiency is higher, then companies could suffer less from the negative effects of the crisis or even derive positive effects from it. The results that we were able to analyze following the application of the regression do not confirm our hypothesis. The interaction effect observed between high investment efficiency and Covid years exhibits a statistically non-significant negative correlation with ROA. This suggests that we cannot draw any empirical evidence to support the notion that high investment efficiency influences firm performance during the health crisis period. Moreover, additional analyzes including propensity scores matching confirmed these results by still showing a non-statistically significantly negative relationship between high investment efficiency and Covid years, which validates our reasoning. On the other hand, we identified a positive impact of high investment efficiency on ROA, indicating that companies with greater investment efficiency experience increased performance. This latter finding is consistent with research elaborated by the academic community. Indeed, Fauziah et al. (2021), Chen & Lin (2013), Ma & Jin (2016) and Salehi et al. (2022), tested the impact of investment efficiency on financial performance and found that it was positive and could improve performance and maximize company value. On this point, we can therefore say that our results are consistent with previous studies. However, our non-statistically significant results resulting from the effect of investment efficiency combined with the Covid-19 pandemic do not agree with the theories of the importance of investment efficiency in times of uncertainty.

Hypothesis 4 examines the character of risk associated with the different sectors and its combined impact of the Covid-19 pandemic on performance. As a reminder, the sectors characterized as high-risk sectors are those characterized by high social interaction, a strong staff presence or a high import/export rate, while the low-risk sectors present the opposite characteristics. The expectation was that companies included in low-risk sectors would experience a lower decline in performance or even an improvement in performance compared to high-risk sectors. However, the results from the linear regression analysis are inconsistent with the findings from the literature and do not support our hypothesis. Specifically, the interaction effect of low-risk sectors and Covid years showed a statistically non-significant negative correlation with ROA. This means that there is no empirical evidence to suggest that the risk character of sectors significantly influences financial performance during the health crisis period. In contrast, additional analyzes including propensity scores matching showed this time a null relationship between firms included into low-risk sectors and Covid years. However, these results were non statistically significant again, which do not lead us to draw different conclusions. This finding contradicts the empirical evidence presented by Shen et al. (2020), who suggested that the negative impact of COVID-19 on firm performance is more significant in industries with the same characteristics. As a result, Hypothesis 4 is completely rejected, whether considering the health crisis or not.

The last hypothesis whose results remain to be analyzed is Hypothesis 5. Hypothesis 5 studies the effect of the first factor external to the firm. It assumes that the government subsidies that have been provided to a large number of companies during the health crisis can help companies reduce their decline in financial performance. Our results show a partial consistence with scientific literature. Indeed, the findings elaborated thanks to our regression analysis demonstrate a statistically significantly positive impact of government subsidies on ROA, indicating that companies with public support experienced increased performance compared to companies without public support. Prior literature from Jin et al. (2018), Liu et al. (2019) and Zhang et al. (2014) confirms this statement. However, the interaction effect between government support and the Covid years showed a statistically non-significant negative correlation with ROA. Additional analyzes including propensity scores matching confirmed these results by still showing a non-statistically significantly negative relationship between government subsidies and Covid years, which do not lead us to draw different conclusions. This suggests that the empirical results do not allow us to determine an influence

relationship between financial performance and receipt of government subsidies in 2020 and 2021. Therefore, the analysis of our regression results rejects Hypothesis 5 on this point.

VI. CONCLUSION

1. Summary of the main findings

The Covid-19 pandemic, an unparalleled global crisis, has posed significant challenges to businesses worldwide, including Belgian firms. Through a comprehensive literature review, this master thesis examined the impact of the Covid-19 pandemic on the economy, drawing parallels from past economic crises and investigating the factors that cause a drop in performance for companies during such downturns. Additionally, it explored financial characteristics that can potentially enable firms to mitigate the effects of economic crises. Building on this foundation, the thesis developed five hypotheses, focusing on factors that could positively impact business performance during the Covid-19 crisis.

The multiple linear regression models conducted in this study yielded unexpected results. Contrary to expectations based on the severity of the crisis, the findings indicate that the impact of the Covid-19 pandemic on Belgian firm performance was positive, which rejects our main hypothesis. However, we have observed in several other previous research that the impact of the pandemic is not necessarily always negative or is even sometimes insignificant. Therefore, the results of our research support these studies.

Afterwards, several hypotheses based on the interaction between the pandemic and certain mitigating factors were tested, the aim being to identify factors that could mitigate the negative effects of the crisis on performance or even increase it. Among these factors, we studied in particular the effects of financial flexibility, the efficiency of investments, certain sectors considered to be at lower risk, and the presence of government subsidies. The results of the linear regressions linked to these hypotheses first demonstrated that three of these factors are relevant given their impact on business performance: indeed, financial flexibility, investment efficiency and government subsidies presented a positive and statistically significant impact on the performance of Belgian companies. On the other hand, the fact that a company belongs to a low-risk sector has a statistically significant negative impact on financial performance.

Regarding the interaction of these four factors with the Covid-19 pandemic, our study did not reveal any truly reliable results, statistically speaking. For each hypothesis, the effect relating to the interaction of each factor with the Covid years, respectively, has always been negative with respect to the performance of the companies. Moreover, none of these effects could be considered statistically significant. These results were maintained during additional analyses, carried out using propensity scores matching, in order to avoid biases of equality of distributions as much as possible. Therefore, despite the demonstrated relevance of the factors chosen, we cannot draw any empirically and statistically valid conclusions on the mitigating effects of each of these factors on the Covid-19 health crisis and are obliged to reject our hypotheses. However, our study is subject to many limitations and can be improved through deeper research.

2. Limitations and further recommendations

This thesis has some limitations that need to be acknowledged. Firstly, due to the recent occurrence of the pandemic, there is a scarcity of literature on this topic, making it challenging to compare the findings with existing research. We can see the effects of this limitation for some of our hypothetical factors, the effects of which have only been tested in past crises or during periods of economic uncertainty. As a result, it is difficult to always be certain of the relevance of the factors chosen. In addition, it forces us to look more broadly in all academic studies to obtain references, which sometimes leads us to rely on the impact of certain factors on indicators other than ROA to materialize performance.

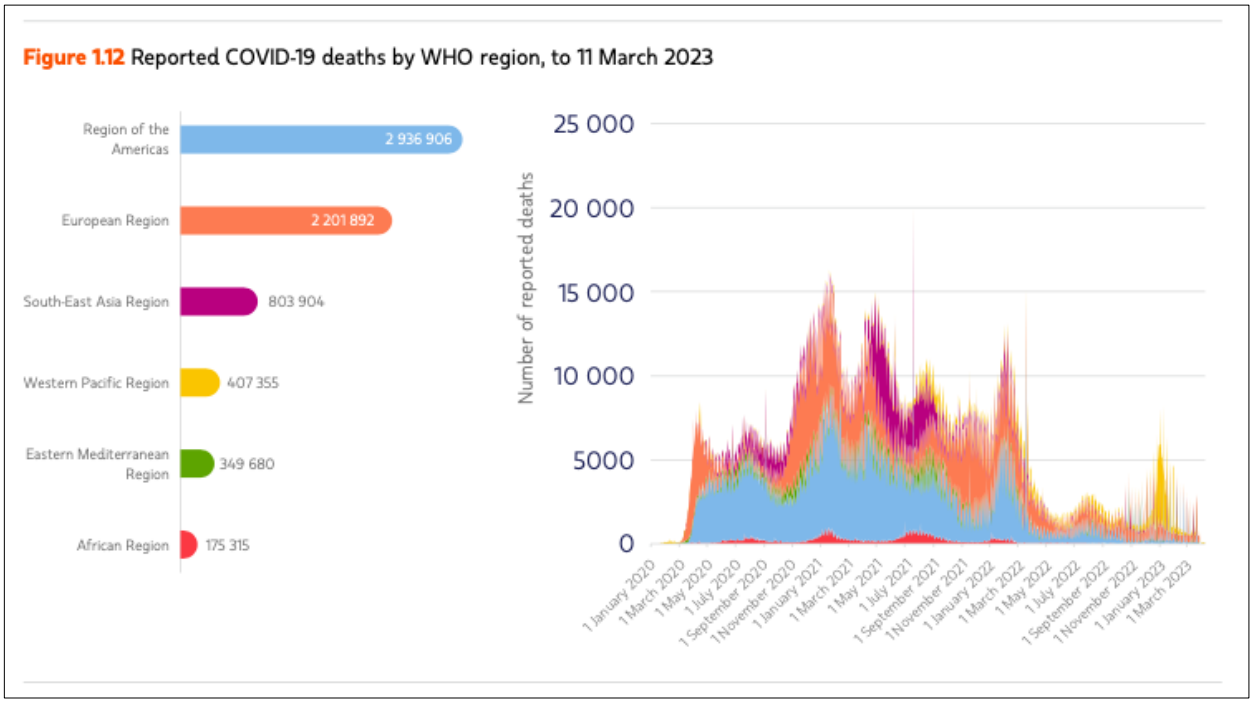
Then, it is important to take precautions with respect to the modeling of our hypotheses, and in particular that concerning government subsidies. Indeed, if the data indicates the amount of public subsidies received per year, there is no way to be certain that these subsidies are due to the pandemic. As explained earlier in this master thesis, government subsidies have been distributed to companies in many forms, and not necessarily only in cash. This implies that there may have been other additional or complementary subsidies, the impact of which cannot be studied. The "Subsidies received by public authorities" account present on the Belfirst database has been the best approximation we have where to find, but it is important to remember that it is by no means exhaustive and that it may lead to certain biases. Moreover, if the hypothesis concerning high or low risk sectors has been constructed thanks to literature sources, it is also necessary to remember that it has also been subject in part to personal interpretations, particularly in the classification of sectors, which may also imply bias.

The same is true for the choice of variables and models. These have always been constructed on the basis of scientific studies, but there is no general consensus among the authors on one or the other indicator, or one or the other model. Therefore, it is also important to keep an objective eye on this master thesis at this level.

In view of the many limitations of this research and the non-statistical significance of some of the results, we can clearly deduce that this topic requires deeper and more elaborate research. Further research could explore the long-term impact of the pandemic on business performance. Investigating how firms adapt and evolve over time in response to the crisis can provide valuable insights into their resilience and long-term survival strategies. Elaborating this study over the long term would allow us to have more perspective on the situation as well as more literature developed on the subject. This study would also be interesting to develop in terms of cross-country impact, in order to be able to draw comparisons.

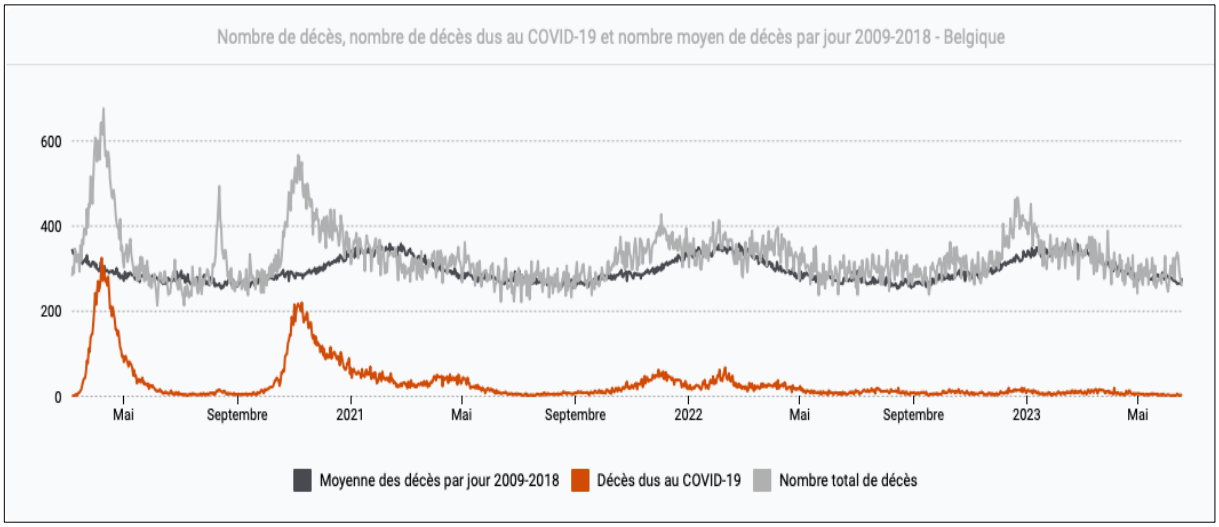
VII. APPENDICES

Figure 0.1: Reported distribution of the number of Covid-19 deaths in the world



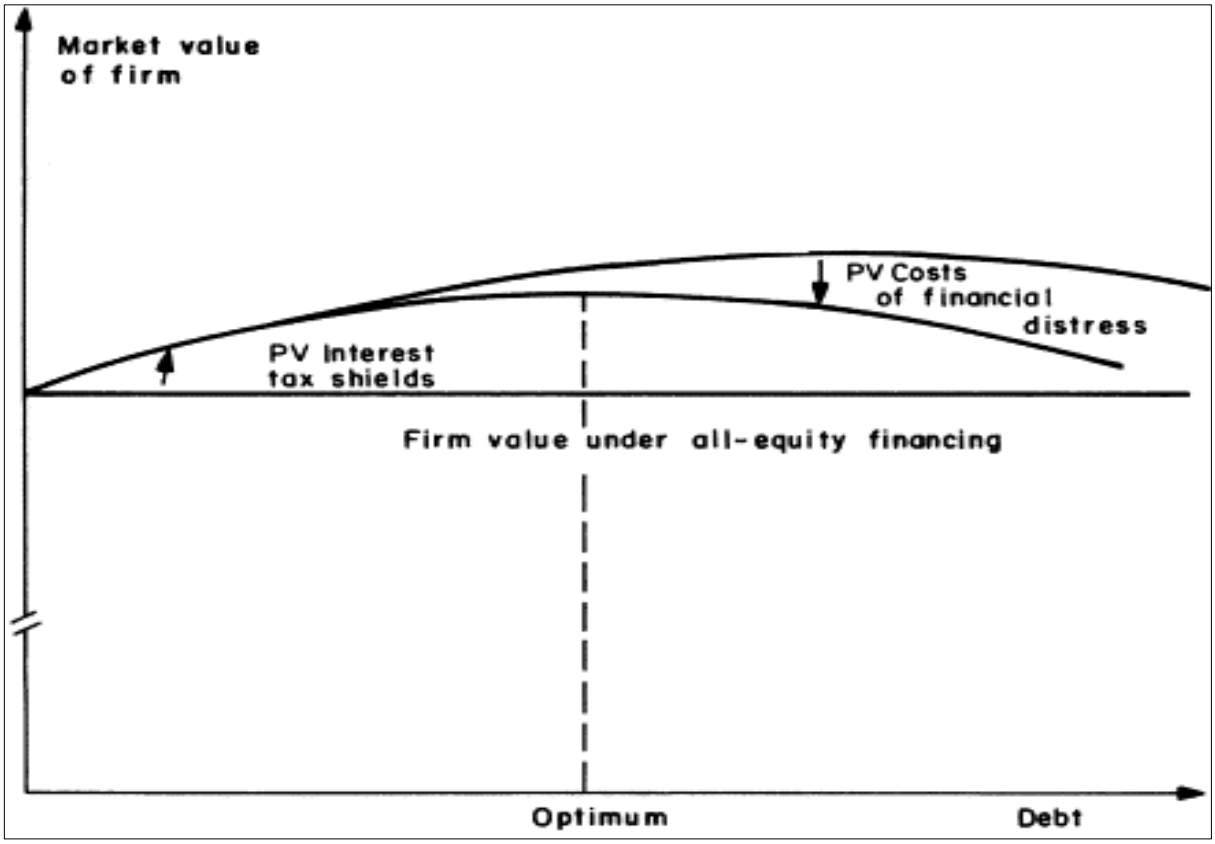
Source: World Health Organization (2023). *Reported COVID-19 deaths by WHO region, to 11 March 2023.* [online image]. World Health Organization. https://www.who.int/publications/i/item/9789240074323

Figure 0.2: Deaths, deaths due to Covid-19 and average number of deaths 2009-2018 in Belgium



Source : Nombre de décès, nombre de décès dus au COVID-19 et nombre moyen de décès par jour 2009-2018 – Belgique. [online image]. Statbel. https://statbel.fgov.be/fr/figures/nombre-de-deces-dus-au-covid-19-et-nombre-total-de-deces

Figure 0.3: Trade-off theory



Source: Shyam-Sunder & Myers (1999). *The static tradeoff theory of optimal capital structure.* [online image]. ScienceDirect. https://www.sciencedirect.com/science/article/pii/S0304405X98000518

Table 0.1: Risk characterization of sectors

NACE	Global Sector Name	Risk Characterization
1-3	Culture, agriculture, hunting and forestry services	Low Risk
5-9	Mineral extraction	Low Risk
10-12	Food and beverage industry	High Risk
13-15	Textile industry	High Risk
16-18	Wood, paper, cardboard industry	High Risk
19-21	Chemical and pharmaceutical industry	High Risk
22-33	Manufacturing industry	High Risk
35-39	Electricity industry and water treatment	Low Risk
41-43 + 71	Construction and buildings activities	Low Risk
45-47	Trade services	High Risk
49-53	Transport services	High Risk
55-56	Catering and accommodation industry	High Risk
58-61	Communication and media	Low Risk
62-63	IT services	Low Risk
64-69	Financial services and insurance	Low Risk
68 + 77 + 81	Real estate industry	Low Risk
70 + 73 + 78 + 82 + 99 + 94	Employment and management activities	Low Risk
72 + 74	R&D services	Low Risk
80+84	Security activities	Low Risk
85	Education	High Risk
86-88 + 75	Social and health industry	High Risk
90-93+79	Travel, leisure, entertainment, arts industries	High Risk
95-98	Housekeeping and other personal services	Low Risk

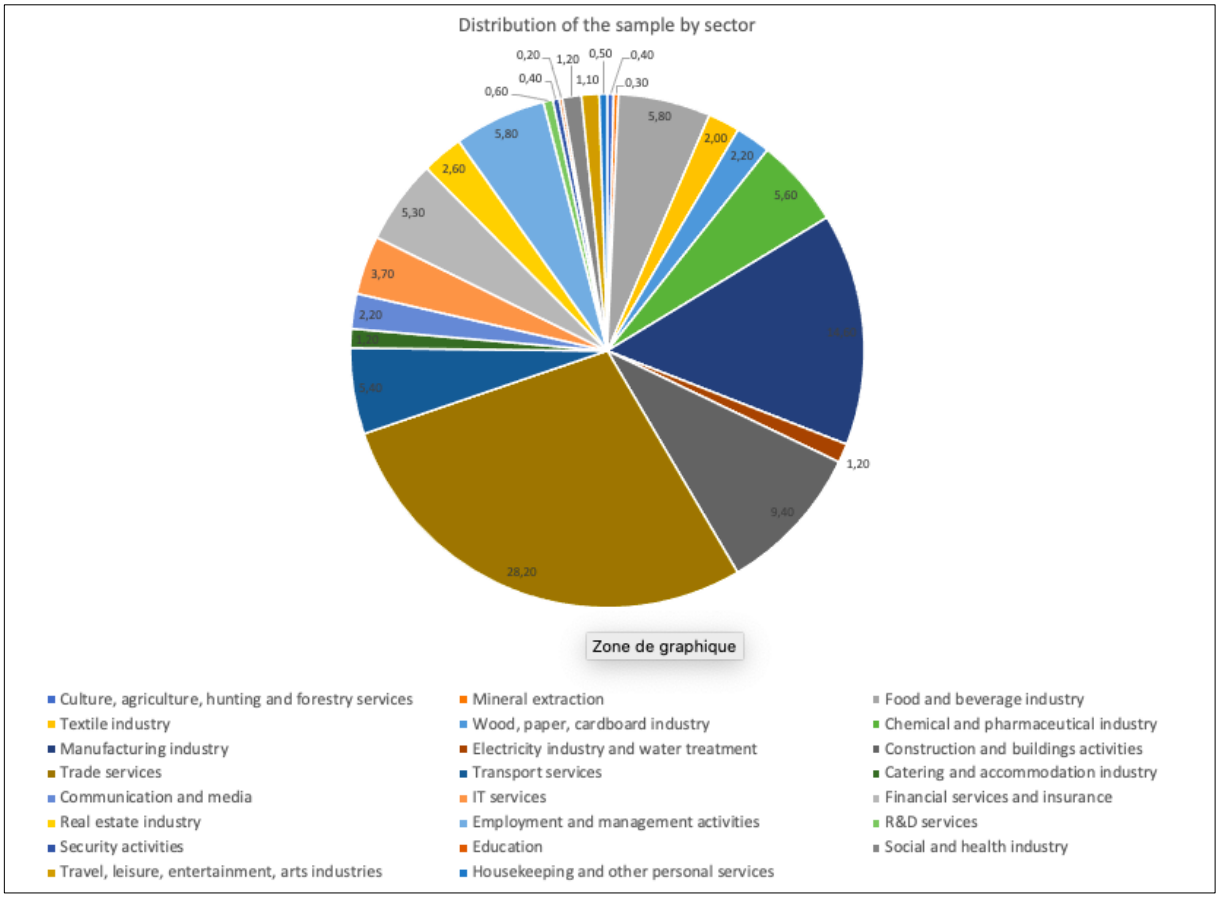
Source: Author's work, using Bel-First database

Table 0.2: Distribution of the sample

NACE	Global Sector Name	# of observations	Percentage
1-3	Culture, agriculture, hunting and forestry services	54	0.4%
5-9	Mineral extraction	36	0.3%
10-12	Food and beverage industry	726	5.8%
13-15	Textile industry	252	2.0%
16-18	Wood, paper, cardboard industry	276	2.2%
19-21	Chemical and pharmaceutical industry	702	5.6%
22-33	Manufacturing industry	1829	14.6%
35-39	Electricity industry and water treatment	150	1.2%
41-43 + 71	Construction and buildings activities	1182	9.4%
45-47	Trade services	3522	28.2%
49-53	Transport services	672	5.4%
55-56	Catering and accommodation industry	150	1.2%
58-61	Communication and media	270	2.2%
62-63	IT services	462	3.7%
64-69	Financial services and insurance	666	5.3%
68 + 77 + 81	Real estate industry	324	2.6%
70 + 73 + 78 + 82 + 99 + 94	Employment and management activities	726	5.8%
72 + 74	R&D services	78	0.6%
80+84	Security activities	48	0.4%
85	Education	24	0.2%
86-88 + 75	Social and health industry	156	1.2%
90-93+79	Travel, leisure, entertainment, arts industries	138	1.1%
95-98	Housekeeping and other personal services	60	0.5%
Total		**12,509**	**100%**

Source: Author's work, using Bel-First database

Figure 0.4: Distribution of the sample by sector



Source: Author's work, using Bel-First database

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IX. EXECUTIVE SUMMARY

The emergence of the Covid-19 pandemic in early 2020 marked an unparalleled worldwide crisis, impacting nearly every facet of society, including public health, social dynamics, and economic operations. As the pandemic unfolded, it became increasingly evident that the business landscape would undergo significant disruptions, with numerous companies grappling with a multitude of challenges in order to navigate and prosper within this unanticipated and adverse environment. In this master's thesis, we aim to delve into the key factors that may influence the performance of Belgian enterprises during the Covid-19 crisis. Our focus is on identifying variables that could potentially have a positive effect on business performance amid this economic downturn.

The master's thesis is structured into several core chapters. To begin, the literature review presents relevant theoretical dimensions pertaining to our subject matter. This provides us with a profound understanding of the topic, enabling the formulation of hypotheses. The review delves extensively into the economic repercussions of the Covid-19 pandemic, drawing parallels with previous economic crises. Furthermore, it explores the mechanisms through which economic downturns lead to a decline in business performance and investigates how companies can leverage financial attributes to mitigate the effects of such crises. This foundation leads to the formulation of five hypotheses concerning the determinant factors influencing Belgian firm performance during the Covid-19 crisis. These hypotheses are subsequently tested through the construction of five models utilizing multiple linear regression techniques.

The analysis of our findings reveals unexpected outcomes. Contrary to initial expectations based on the severity of the crisis, the results suggest a positive impact of the Covid-19 pandemic on the performance of Belgian firms, thus rejecting our primary hypothesis. However, our observations align with several previous studies that have indicated the pandemic's impact is not universally negative and, in some instances, even negligible. Therefore, our research results align with and support these existing findings.

The other hypotheses centered on the interaction between the pandemic and specific mitigating factors are also tested. The objective was to identify factors that could alleviate the negative impact of the crisis on performance or potentially enhance it. Among these factors, we particularly examine the influence of financial flexibility, investment efficiency, select lower-risk sectors, and government subsidies. The linear regression results pertaining to these hypotheses demonstrates the relevance of three factors due to their positive and statistically significant impact on business performance: specifically, financial flexibility, investment efficiency, and government subsidies. Conversely, membership in a lower-risk sector is found to have a statistically significant negative effect on financial performance.

Regarding the interaction of these four factors with the Covid-19 pandemic, our study do not yield robust and statistically significant results. For each hypothesis, the interaction effect between each factor and the Covid years consistently displays a negative association with company performance. Moreover, none of these effects achieves statistical significance. These outcomes persist even during supplementary analyses conducted using propensity score matching, aimed at mitigating distributional biases. Consequently, despite the demonstrated relevance of the chosen factors, we are unable to draw empirically and statistically valid conclusions regarding their mitigating effects on the Covid-19 health crisis. As a result, we must reject our hypotheses. Nevertheless, our study is subject to numerous limitations and presents avenues for further research and improvement, but the aim of this thesis is to contribute to the formulation of impactful strategies that can support businesses in navigating and persevering through this unparalleled crisis.

Word count = 28,292 words.